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NEW STATE RECORDS FOR *CITRULLUS*, *CUCUMIS*, AND *CUCURBITA* (CUCURBITACEAE) OUTSIDE OF CULTIVATION IN THE USA

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ABSTRACT

New records for *Cucurbita moschata* Duchesne outside of cultivation are documented for Mississippi, Louisiana, and Texas. Diagnostic features useful for the distinction of *C. moschata* and *C. pepo* are briefly discussed and illustrated. *Cucumis anguria* var. *anguria* is documented to occur in Georgia. The occurrence in California is documented for *Citrullus colocynthis*. The distribution of *Cucumis melo* subsp. *agrestis* is considered and augmented county distributions are given for Texas and Louisiana.

KEY WORDS: *Cucurbita moschata*, *Cucurbita pepo*, *Citrullus colocynthis*, *Cucumis anguria*, *Cucumis melo* subsp. *agrestis*, Cucurbitaceae, naturalized, USA

Four of the five domesticated species of *Cucurbita* are known to grow outside of cultivation in the USA: *C. ficifolia* Bouché, *C. maxima* Duchesne, *C. moschata* Duchesne, and *C. pepo* L. (as summarized by USDA, NRCS 2010). *Cucurbita moschata* has previously been reported to escape from cultivation in the USA in Florida, Georgia, North Carolina, Pennsylvania, South Carolina, and Virginia (Duncan & Kartesz 1981; Rhoads & Block 2007; Weakley 2010; Wunderlin & Hansen 2010) and its similar occurrence is documented here from three additional states of the eastern USA.

Cucurbita moschata. **Louisiana**. Bossier Par.: 4.7 mi N of Benton, ditchbank, sandy clay, 14 Jun 1956, *Shinners 23805* (SMU). **Mississippi**. Washington Co.: [ca. 6 mi SW of Hollandale], 0.6 mi W of Hwy MS 1, 0.2 mi S of Fisher Rd, Marathon Plantation, weed in cotton field, 16 Jul 1993, *Bryson 12500* (BRIT, VDB). **Texas**. Dallas Co.: Richardson, 1.5 mi W of Holford on Big Springs Rd, old native field, plant probably from seed in trash, 26 Jun 1989, *Hodges 453* (SMU); Grand Prairie, North Carrier Pkwy and NW 19th, into park about 3 blocks, probably a cultivated escape, 13 Nov 1974, *Wenk 1B* (BRIT). Smith Co.: western Tyler, one plant in waste ground back of Cottage Hill Courts, stems prostrate, ca. 1 m long, 7 Aug 1950, *Cory 57512* (SMU).

Over its range in the USA, the species flowers mostly in May through October and has been collected from various habitats outside of cultivation: oak-pine woods, agricultural fields, brush and trash heaps, roadsides, ditch banks, vacant lots, and disturbed sites. In addition to the USA localities, *C. moschata* has been reported as naturalized in the West Indies, Central America (Belize), and South America (Galapagos, Guyana, Surinam, French Guiana). In most cases, at least in the USA, these plants probably are most accurately characterized as "waifs" (Nesom 2000) as they apparently do not maintain themselves in persistent populations.

Cucurbita moschata Duchesne, Essai Hist. Nat. Courges, 7, 15. 1786.

The species has sometimes been identified as *Cucurbita moschata* (Duchesne ex Lam.) Duchesne ex Poir. (Dict. Sci. Nat. (ed. 2) 11: 234. 1819), based on *Cucurbita pepo* var. *moschata* Duchesne ex Lam. (Encyl. 2: 152. 1786), but the name at specific rank appeared first in Duchesne's Essai of 1786, published slightly earlier than Lamarck's Encyclopedia.

Cultivars of *Cucurbita moschata* include butternut squash, golden cushaw, calabaza, winter squash, crookneck squash, neck pumpkin, Tahitian squash, West Indian pumpkin, Seminole pumpkin, large cheese pumpkin, Long Island cheese pumpkin, Tennessee sweet potato, Kentucky field pumpkin, Dickinson pumpkin, and others. The wild ancestor of *C. moschata* is unknown, but mitochondrial NDA data combined with other information suggest that it will be found in lowland northern South America (Sanjur et al. 2002).

Notes on identification.

Most of the collections recorded here as *Cucurbita moschata* were originally identified as *C. pepo* sensu lato, including var. subsp. *ovifera* (L.) Decker (domesticated forms include jack-o-lantern pumpkin, zucchini, pattypan squash, scallop squash, yellow squash crookneck squash, straightneck squash, acorn squash, summer squash, spaghetti squash, cocozelle, and others). The two species can be distinguished by the following contrasts.

1. Stems, peduncles, and leaves moderately hirsutulous to puberulent and also moderately villous with unicellular-based hairs; calyx lobes narrowly lanceolate, thin-foliaceous, weakly hirsute to villous; fruiting peduncles abruptly and widely expanded at point of fruit attachment; seed surface somewhat punctate-sculptured, margins raised-thickened and somewhat undulate-hyaline, golden-yellow to silvery ..... **Cucurbita moschata**
1. Stems, peduncles, and leaves sparsely to moderately hispid with pustulate-based hairs; calyx lobes linear to subulate-linear, stiff, usually hirsute-hispid; fruiting peduncles not abruptly expanded at point of fruit attachment or very gradually expanding toward it; seed surface essentially smooth, margins raised-thickened and smooth, same color as the surface ..... **Cucurbita pepo**

An unequivocal distinction between these two species is best made through comparison of peduncles of mature fruits (Fig. 1) and seed morphology, but these are rarely available on herbarium collections or even in the field.

The development of foliaceous calyx lobes in *Cucurbita moschata* also appears to be diagnostic, but they vary from narrowly lanceolate (and hardly foliaceous) to distinctly broadened distally (and obviously foliaceous), thus the usefulness of this feature is not consistent. Vestiture of the calyx lobes appears to provide a useful but not entirely consistent distinction, because calyx vestiture in *C. pepo* is somewhat variable.

Vestiture of stems, peduncles, and leaves provides a useful character but, again, that of *Cucurbita pepo* is variable and the vestiture does not appear to be consistently diagnostic. In subsp. *pepo*, which includes most cultivated forms (cocozelle, jack-o-lantern pumpkins, vegetable marrow, zucchini, and some ornamental gourds), there are consistently two essential types of hairs — a shorter, thinner-walled and non-rigid type usually relatively densely distributed, and a longer, thicker-walled and rigid type more sparsely distributed. The rigid hairs characteristically arise from a "pustulate" base, which is many-celled and often distinctly broadened beyond the distal diameter of the trichome. In subsp. *ovifera* (L.) Decker, which includes the free-living var. *texana* (Scheele) Decker and var. *ozarkana* Decker-Walters and the primarily cultivated but escaping var. *ovifera* (L.) Alef. (with most ornamental gourds and the scallop, acorn, crookneck, and straightneck squashes), the pustulate-based hairs may be absent in some plants of all three entities, and development of the trichome base of the longer and rigid hairs varies from strongly pustulate (many-celled) to weakly so (1- or few-celled).

CITRULLUS

1. Citrullus colocynthis (L.) Schrad. — colocynth, bitter apple, bitter cucumber, vine of Sodom. Colocynth has been reported as a weed in Texas peanut fields (Smith & Cooley 1973; de Aquino Assis et al. 2000) and is included in the checklist by Hatch et al (1990), but a documenting voucher for Texas has not been seen for this report. The occurrence of colocynth is California is documented here.

Citrullus colocynthis. **California**. Kern Co.: San Joaquin Valley, Twisselman Road and Hwy I-5, 4.9 mi S of Kings Co. line, formerly saltbush scrub with *Atriplex polycarpa* and *Sueda*, now mostly cleared and planted to cotton, 220 ft; fairly common annual vine on a pond dike, fruit green with lighter blotches until ripe when uniformly yellow-green, largest 20 cm long, 12 cm in diam., flesh greenish yellow, no flavor and only vaguely watermelon scented, 12 Sep 1986, *Sanders 6940* (NLU).

The following set of contrasts distinguishes *Citrullus colocynthis* from *C. lanatus*, which is commonly encountered as an escape, mostly from seeds of discarded watermelons. Label data for the California collection of colocynth note that it was an "annual vine" but the root was not included as part of the specimen.

1. Perennials; stems pustulate-scabrous to pustulate-hispid; tendrils unbranched or rarely 2-fid; fruit 4–7(–10) cm in diameter, mesocarp dry-spongy, light yellowish-orange to pale yellow, intense bitter ..... **Citrullus colocynthis**
1. Annuals; stems villous; tendrils 2–3-fid; fruit 12–35 cm (or more) in diameter, mesocarp fleshy, red to orange or yellow, rarely white, sweet ..... **Citrullus lanatus**

Colocynth is a traditional food plant in Africa, grown particularly for its edible seeds, which are bitter but nutty flavored and rich in fat and protein, eaten whole or used as an oilseed. It also has been a standard cathartic remedy, mostly in combination with other cathartics. It is native to Africa, Pacific Islands, Europe, Asia; introduced also in Australia.

CUCUMIS

1. Cucumis anguria L. — West Indian gherkin, bur gherkin. Bur gherkin has been reported as an escape in California, Massachusetss, New York, Oregon, and Washington (var. *anguria*) and in Alabama, Florida, Georgia, Montana, and Texas (var. *longaculeata* Kirkbr.) — a summary of documentation is provided in USDA, NRCS (2010).

Two varieties within the bur gherkin were recognized by Kirkbride (1993), who distinguished them by the following contrasts.

1. Fruits obscurely aculeate, aculei 1–2 mm; leaf blades deeply 3–5-palmately lobed ..... **Cucumis anguria** var. **anguria**
1. Fruits prominently aculeate, aculei 4–10(–15) mm; leaf blades deeply 3–5-palmately lobed to weakly 3-lobate or nearly unlobed ..... **Cucumis anguria** var. **longaculeatus**

Cucumis anguria var. *longaculeatus* has been noted to occur outside of cultivation in Georgia (Jones & Coile 1988); occurrence in Georgia of the typical variety is documented here.

Cucumis anguria var. *anguria*. **Georgia**. Sumter Co.: E side of Americas, jct of Vienna Hwy (Ga 27) and Whispering Pines Dr., sandy soil, 430 ft, sprawling vine on disturbed gravelly site, some stems to ca. 6–7 ft, 20 Oct 1996, *Norris 6776* (NLU).

2. Cucumis melo L. subsp. **agrestis** (Naud.) Pangalo — Gulf Coast melon.

Only two formal infraspecific taxa within *Cucumis melo*, subsp. *melo* and subsp. *agrestis*, were recognized by Kirkbride (1993), who suggested that other variants should be treated with horticultural names. Among taxa included within subsp. *agrestis* are *C. melo* var. *agrestis* Naud., var. *chito* (Morren) Naud., var. *dudaim* (L.) Naud., var. *flexuosus* (L.) Naud., and var. *texanus* Naud.

Classification of melons into two subspecies has been generally supported by molecular phylogenies (Stepansky et al. 1999; Decker-Walters et al. 2002). Following Kirkbride's treatment (1993), the two taxa are distinguished by the following contrasts.

1. Hypanthium or youngest fruits retrorsely or antrorsely sericeous with appressed hairs; stems hispid with retrorse hairs; fruit 2.5–5 cm in diam. ..... **Cucumis melo** subsp. **agrestis**
1. Hypanthium or youngest fruits pilose to lanate with spreading hairs; stems glabrous sparsely villous; fruit greater than 10 cm in diam. ..... **Cucumis melo** subsp. **melo**

Free-living populations of subsp. *agrestis* in the New World commonly have been assumed to represent escaped forms of cultivated var. *chito* or var. *dudaim* or less commonly of var. *agrestis*. Decker-Walters et al. (2002), however, showed that populations in the southeastern USA are morphologically and molecularly distinct and appropriately recognized as var. *texanus*. This variety shows the greatest genetic affinities to var. *chito* and to cultivars from Eastern Asia. Its wild or cultivated progenitor presumably was brought to the Western Hemisphere by humans intentionally (e.g., by Asian immigrants) or unintentionally (e.g., as seeds mixed with those of other introduced crops), either in pre-Columbian times (given the distinctiveness of genetic differentiation) or post-Columbian.

Cucumis melo subsp. *agrestis* in the flora area is documented by the following that I have studied: **Arkansas**. Lafayette Co.: 3 mi N of Gin City along Red River levee, fallow fields and field margins, 8 Sep 1988, *Sundell et al. 8654* (BRIT, VDB); ca. 3 mi NW of Canfield, levee above Field Bayou, 8 Sep 1988, *Sundell et al. 8670* (BRIT, VDB). **Connecticut**. Hartford Co.: town of Windsor, landfill, Huckleberry Rd, moist sandy waste areas near dumpsters adjacent of leaf dump, 18 Sep 1998, *Zebryk 5761* (NLU). **Florida**. Charlotte Co.: Port Charlotte Beach State Recreation Area, Manasota Key, N portion of park, beach dune 25 Jun 1991 *Erickson PB0052* (USF digital image!). Additionally, the ISB Atlas of Florida Vascular Plants (with specimen images) provides vouchers for 16 other counties, identified simply as *C. melo*; the FSU online database includes another three counties, for a total of 20 Florida counties. **Georgia**. Bryan Co.: Ft. Stewart Military Reservation, Training Area C-18, just W of Richmond Hill, jct Ga. Hwy 144 and FS 58, local in sandy disturbed loam, 22 Jul 1992, *Carter 10223* (VDB). **Louisiana**. Ouachita Par.: 1 mi NE of Bayou Lafourche, beside La 15, ditch banks and edge of soybean field, 10 Jul 1972, *Thomas 30836* (NLU). **Mississippi**. Warren Co.: just W of Yazoo River, Hwy 465, frequent on roadside and open disturbed places near water, 24 Sep 1972, *Rogers 8739* (BRIT, SMU); the MISS online checklist also shows collections from Washington and Wilkinson counties. **North Carolina**. New Hanover Co.: Wilmington, garbage dump S of Smith Creek and E of US 117, 21 Jul 1970, *Leonard 3339* (VDB). **Oklahoma**. Kingfisher Co.: 8 mi W of Dover, *Quercus marilandica-Q. stellata* woods beside road, between Crescent and US 81, 9 Oct 1970, *Thomas 21846* (NLU); McCurtain Co.: along river, 8 Oct 1977, *J. & C. Taylor 25638* (BRIT). **Tennessee**. Hamblen Co.: along Southern Railway tracks at US 25E in Morristown, 15 Aug 1981, *Thomas 77886* (NLU). **Texas**. Calhoun Co.: 15 1/4 mi SW of Port Lavaca, frequent on hwy embankment in river bottoms, 24 Nov 1945, *Cory 51136* (SMU).

Wilson (1993) provided a county-level map with documentation for *Cucumis melo* subsp. *agrestis* (as var. *texana*) in 12 states (including 125 counties): Texas, Arkansas, Louisiana, Oklahoma, Kansas, Missouri, Illinois, Indiana, Kentucky, Tennessee, Alabama, and Mississippi. In Mexico,

subsp. *agrestis* is known to occur in the states of Baja California, Baja California Sur, Sinaloa, Sonora, and Tamaulipas.

Cucumis melo subsp. *agrestis*, as identified by the criteria above, is abundantly documented in Louisiana by collections at NLU from 49 parishes: Acadia, Allen, Ascension, Assumption, Avoyelles, Beauregard, Bienville, Caddo, Calcasieu, Caldwell, Cameron, Catahoula, Claiborne, Concordia, Desoto, East Baton Rouge, East Carroll, Evangeline, Franklin, Iberia, Iberville, Jefferson, Jefferson Davis, Lafayette, Lafourche, LaSalle, Lincoln, Madison, Morehouse, Natchitoches, Orleans, Ouachita, Rapides, Red River, Richland, Sabine, St. Charles, St. Landry, St. Martin, St. Mary, Tensas, Terrebonne, Union, Vermilion, Washington, Webster, West Carroll, West Feliciana, and Winn. A collection from West Baton Rouge Parish is at SMU.

Subsp. *agrestis* in Texas is documented from various sources from 52 counties. From TEX-LL and SMU-BRIT: Brazoria, Burleson, Calhoun, Cameron, Chambers, DeWitt, Erath, Galveston, Harris, Hidalgo, Houston, Jackson, Jefferson, Jim Wells, Matagorda, Refugio, San Patricio, San Saba, Sutton, Travis, Waller, Webb, and Williamson. Additional counties from the TAMU online database: Brazos, Caldwell, Colorado, Grimes, Hill, Robertson, and Uvalde. Wilson (1993) documented its occurrence in an additional set of counties: Aransas, Bell, Bexar, Comal, Denton, Dewitt, Fayette, Goliad, Gonzales, Hamilton, Kinney, Kleberg, Lee, Llano, Madison, Menard, Milam, Navarro, San Jacinto, Trinity, Valverde, and Washington.

Label data indicate that *Cucumis melo* subsp. *agrestis* grows in a wide range of habitats: river and stream banks, lake shores, marsh edges, mangrove edges, bottomland hardwoods, cypress heads, creek beds, sand bars, levees and spoil banks, ditch banks, beach dunes, clearcut woods, burned-over pinelands, fallow fields, pastures, asparagus, alfalfa, soybean, rice, and sugarcane fields, railroad banks, abandoned homesites, vacant lots, roadsides and meridians, fencerows, trash dumps, and other disturbed areas.

Cucumis melo is sometimes encountered outside of cultivation in California, along waterways and irrigation canals, asparagus, cotton, and alfalfa fields, fallow fields, and roadsides. It is mostly identified as var. *dudaim* in that state. The Calflora database records it from 7 counties

Cucumis melo sensu lato is indicated by the PLANTS Database (USDA, NRCS 2010) to occur in 29 states of the USA and in Ontario, Canada — these records probably represent a mix of subsp. *melo* and subsp. *agrestis*. I have seen unequivocally identified collections of subsp. *melo* only from North Carolina, Texas, and Virginia, though it likely occurs wherever cantaloupes are discarded.

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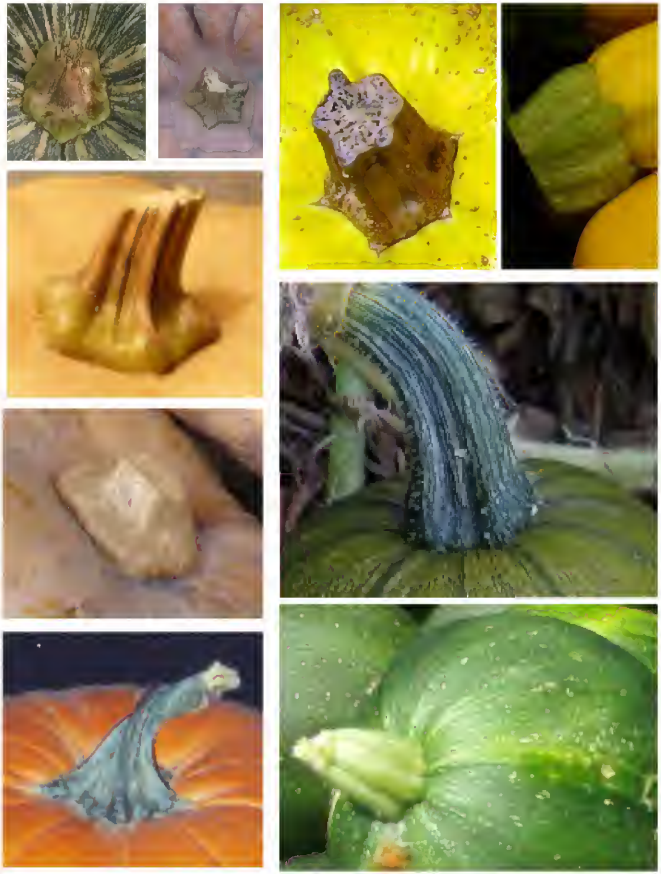

Figure 1. Fruiting peduncles of *Cucurbita moschata* (5 on left) and *Cucurbita pepo* (4 on right).

Turner, B.L. 2011. Overview of the genus *Asterohyptis* (Lamiaceae) and description of a new species from northern Mexico. Phytoneuron 2011-2: 1–6. Mailed 10 January 2011.

OVERVIEW OF THE GENUS *ASTEROHYPTIS* (LAMIACEAE) AND DESCRIPTION OF A NEW SPECIES FROM NORTHERN MEXICO

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ABSTRACT

Asterohyptis is treated as comprising four species, one of these newly described: **Asterohyptis nayarana** B.L. Turner, sp. nov., from Nayarit and southern Durango. A key to the species, distribution maps, and a photo of the type specimen of *A. nayarana* are provided.
KEY WORDS: *Hyptis*, *Asterohyptis*, Lamiaceae, Mexico, Nayarit, Durango

Asterohyptis Epling is a segregate from the genus *Hyptis*, first proposed by Epling (1932) and retained by Harley et al. (2004) in their compendium of the Lamiaceae. As presented here, it is a genus of four species, which are confined to Mexico and Central America. The genus is typified by *A. stellulata* and is distinguished from the large genus *Hyptis* by its numerous small flowers which are arranged in axillary clusters, corolla lobes not thickened, and non-explosive anthers (cf. key characters of Harley et al. 2004, p. 254).

Key to species

1. Mouth of mature calyx tube with a dense annulus of white erect hairs that obscure the throat, the lobes 0.5–0.7 mm long.

2. Leaves ovate to broadly lanceolate, mostly 3–4 times as long as wide, markedly rugose above, the lower surfaces to some degree velutinous; stems densely hirsute with spreading hairs; calyx tube and lobes densely white-tomentose throughout, the lobes obscured; s Durango, ne Nayarit ..... **Asterohyptis nayarana**

2. Leaves linear-lanceolate, mostly 4–6 times as long as wide (rarely not), not noticeably rugose, if at all, the lower surfaces variously hispidulous to puberulent but scarcely velutinous; stems hispidulous with upswept hairs; calyx tube variously white-pilose but the lobes always less so and easily discernible; Sonora, Chihuahua, Sinaloa ..... **Asterohyptis seemannii**

1. Mouth of mature calyx tube loosely pubescent, without a well-defined thick annulus that obscures the throat, the lobes 1.0–3.2 mm long.

3. Mature calyx lobes 2.4–3.0 mm long; mostly 0–1000 m along coastal ranges, Sonora, Sinaloa, Michoacan, Veracruz, Oaxaca, Chiapas, south to Costa Rica ..... **Asterohyptis mociniana**

3. Mature calyx lobes 1.5–2.5 mm long; 1000–2000 m, central highland regions, Nayarit, Jalisco, Michoacan, Morelos, Veracruz, Oaxaca, Chiapas ..... **Asterohyptis stellulata**

ASTEROHYPTIS MOCINIANA (Benth.) Epling, Bull. Torrey Bot. Club 60: 19. 1932. Map 3.
Hyptis mociniana Benth. **TYPE: MEXICO. Veracruz.**
Hyptis spimulosa Benth. **TYPE: MEXICO.** "In Nova Hispania."
Hyptis stellulata var. *sinclairi* Benth. **TYPE: MEXICO. Guerrero.**

Son, Sin, Mic, Ver, Gue, Oax, Cps and Central America. Dry forests and along shore lines, mostly 0-1000 m; flowering: Dec–Jun (rarely later).

Asterohyptis mociniana is known by numerous collections, as indicated in Map 3.

This taxon is essentially similar to *Asterohyptis stellulata* except for calyx size, as indicated in the key. In my first evaluation of the genus, I was inclined to treat *A. mociniana* and *A. stellulata* as synonymous, the characters concerned (those used by Epling to searate the two) not making much biogeographical sense, this largely occasioned by Epling's confusing descriptions, his species accounts contradicting some of the key characters, namely those of the calyces. I restudied all of the taxa and ascertained there was an interesting pattern to the distributions: *A. mociniana*, in Mexico, is largely confined to near coastal habitats (Map 3), *A. stellulata* to more montane, interior habitats (Map 2). Occasional intermediates between the taxa are found, especially along the Pacific coastal regions (e.g., Michoacan, Huizontla, 560 m, 16 Nov 1938, *Hinton et al. 12582* (TEX).

The type of *Asterohyptis mociniana* was reportedly collected by Mocino and Sesse at some unnamed site in the state of Veracruz, Mexico, presumably from or near the port city of Veracruz (McVaugh 1977), to judge from its calyx morphology, this matched by recent near sea level collections, while *Hyptis stellulata* var. *sinclairii* was collected by Sinclair near the port city of Acapulco in Guererro (KEW!).

ASTEROHYPTIS NAYARANA B.L. Turner, sp. nov. Fig. 1, Maps 2 and 3. **TYPE: MEXICO. Nayarit**. Mpio. Nayar, 10 km al NW de la Mesa del Nayar, camino al Cerro Cangrejo, en canada, 22º 15´ N, 104º 40´ W, ca 1300 m, 21 Oct 1989, *Gabriel Flores F. 1694* con O. Tellez V., P. Tenorio L. y A. Cadena (holotype: TEX).

Asterohyptis seemannii similis sed differt caulibus dense hirsutis trichomatibus patentibus (vs. hispidulis trichomatibus antrorsis), foliis ovatis vel late lanceolatis 2–4plo longioribus quam latioribus (vs anguste lanceolatis 4–6plo longioribus quam latioribus) valde rugosis in superficiebus ambabus (vs non rugosis).

Suffruticose herbs or shrublets 1–2 m high. Stems densely villous with spreading hairs, the vestiture ca 0.5 mm high. Leaves ovate to broadly lanceolate, mostly 5–7 cm long, 1.5–2.3 cm wide, markedly rugulose on both surfaces, the margins serrulate; petioles 10–15 mm long. Flowering spikes mostly axillary, interrupted, 6–10 cm long, the glomerules 6–10 mm across, basal bracts linear-lanceolate. Calyces at anthesis ca 2 mm long, densely villous, the lobes ca 0.5 mm long. Corollas white, ca 2.5 mm long, the tube ca 2 mm long. Nutlets glabrous, ca 1 mm long.

Additional specimen examined: **MEXICO. Durango**. Mpio. Mezquital, 10 km al SW de Mezquital, ca 1840 m, selva baja caducifolia, alterada, suelo café rojizo, 11 Sep 1985, *P. Tenorio L. 9593* (TEX).

The novelty is obviously closely related to *Asterohyptis seemannii* but distinct by the set of characters noted in the key. The name derives from the Municipio Nayar, whence the type.

ASTEROHYPTIS SEEMANNII (A. Gray) Epling, Bull. Torrey Bot. Club 60: 20. 1933. Map 2.
Hyptis seemannii A. Gray **TYPE: MEXICO. Sinaloa**.
Hyptis seemannii var. *stenophylla* B.L. Rob. **TYPE: MEXICO. Sonora**.

Son, Chi, Sin and Dur. Mostly oak forests and savanna, 500–1800 m; flowering Sep–Dec.

The species is typified by a Seemann collection from Cerro de Pinal in southern Sinaloa, where it occurs along the Mazatlan-Durango highway. Epling (1933) provided an excellent description of the taxon.

Occasional plants produce more nearly ovate or linear-ovate leaves (Sonora. Alamos, *Palmer 398*, UC) but otherwise differ little from typical *A. seemannii*.

Representative specimens: **MEXICO. Chihuahua.** Mpio. Moris, Moris, 700-1050 m, 29 Sep 1985, *Davila 10069* (TEX, UA); Mpio. Uruachic, Rio Mayo, Batopilillas, 8 Sep 1936, *Gentry 2608* (UA). **Durango.** Mpio. Tamazula, Tamazula, oak forest, 2500 ft, 16 Dec 1939, *Gentry 5224* (UCLA). **Sinaloa.** Mpio. Concordia, Mazatlan-Durango highway, 4 km SW of Liberas, 1540 m, shrub on a steep rocky cliff, ca. 3 m tall, 2 Oct 1985, *Bartholomew 2582* (ASU). **Sonora.** Mpio. Nacore Chico, Pie de la Cuesta, 6 Oct 1939, *Muller 3668* (LL).

This species is closely related to the more northern *Asterohyptis nayarana*, as noted under the latter.

ASTEROHYPTIS STELLULATA (Benth.) Epling, Bull. Torrey Bot. Club 60: 18. 1933. Map 1.
Hyptis stellulata Benth. **Type: MEXICO. Morelos.**
Hyptis pubescens Benth. **Type: MEXICO.** Sessé and Mociño, without locality.

Nay, Jal, Col, Mic, Mex, Mor, Ver, Pue, Gue, Oax, (Cps?) and Central America. Mostly open areas of pine-oak forests, 1000–2000 m; flowering Sep–Nov.

Suffruticose perennial herbs or shrubs 1–4 m high. Leaves broadly ovate to lanceolate, rarely cordate, 2–3 times as long as wide; petioles mostly 1–20 mm long. Spikes both terminal and axillary, interrupted, the floral glomerules 8–12 mm across, basally bracteate with small, leaf-like bracts. Calyces at anthesis with tubes 1.5–2.0 mm long, the teeth 1.5–2.5 mm long. Corollas white, the tubes 1.5–2.0 mm long. Nutlets 1.0–1.3 mm long.

Like *Asterohyptis mociniana*, this taxon is represented in herbaria by numerous collections (Map 1). The type of *A. stellulata* was reportedly collected in the state of Morelos near Cuernavaca by Berlandier (Epling 1933). It is closely related to *A. mociniana* and is largely distinguished by its smaller flowering calyces with shorter lobes. The latter might be treated by some as but a weakly differentiated member of the present complex (cf. comments under *A. mociniana*, above).

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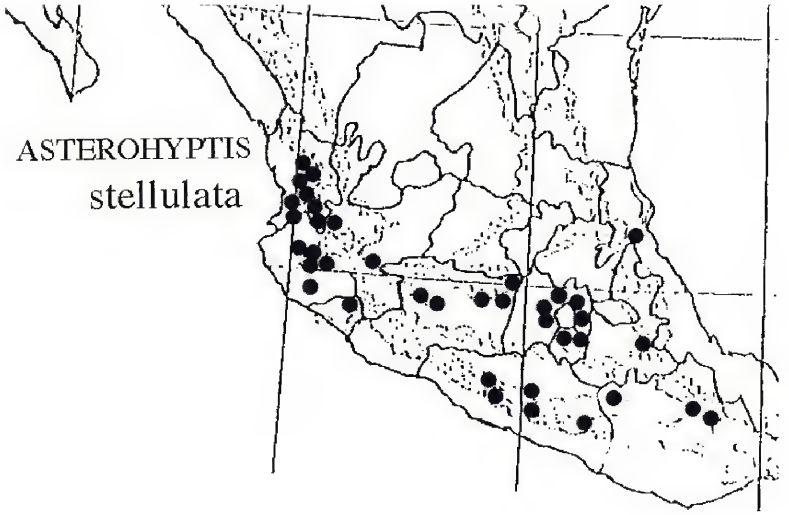
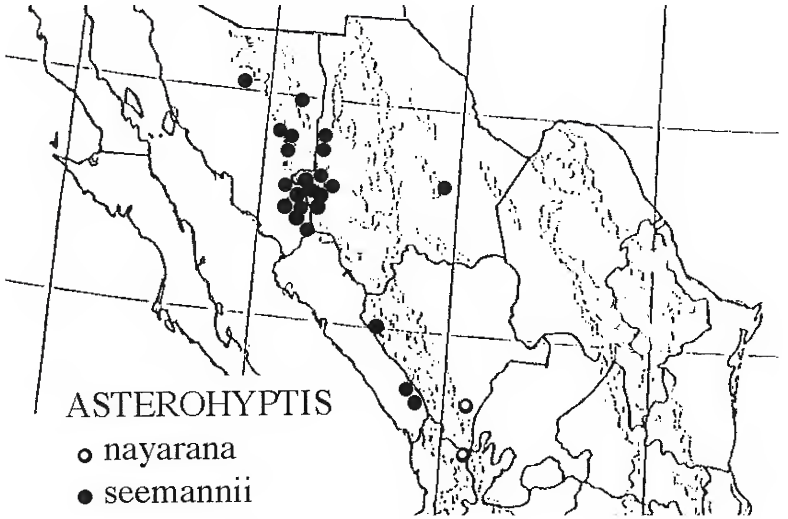
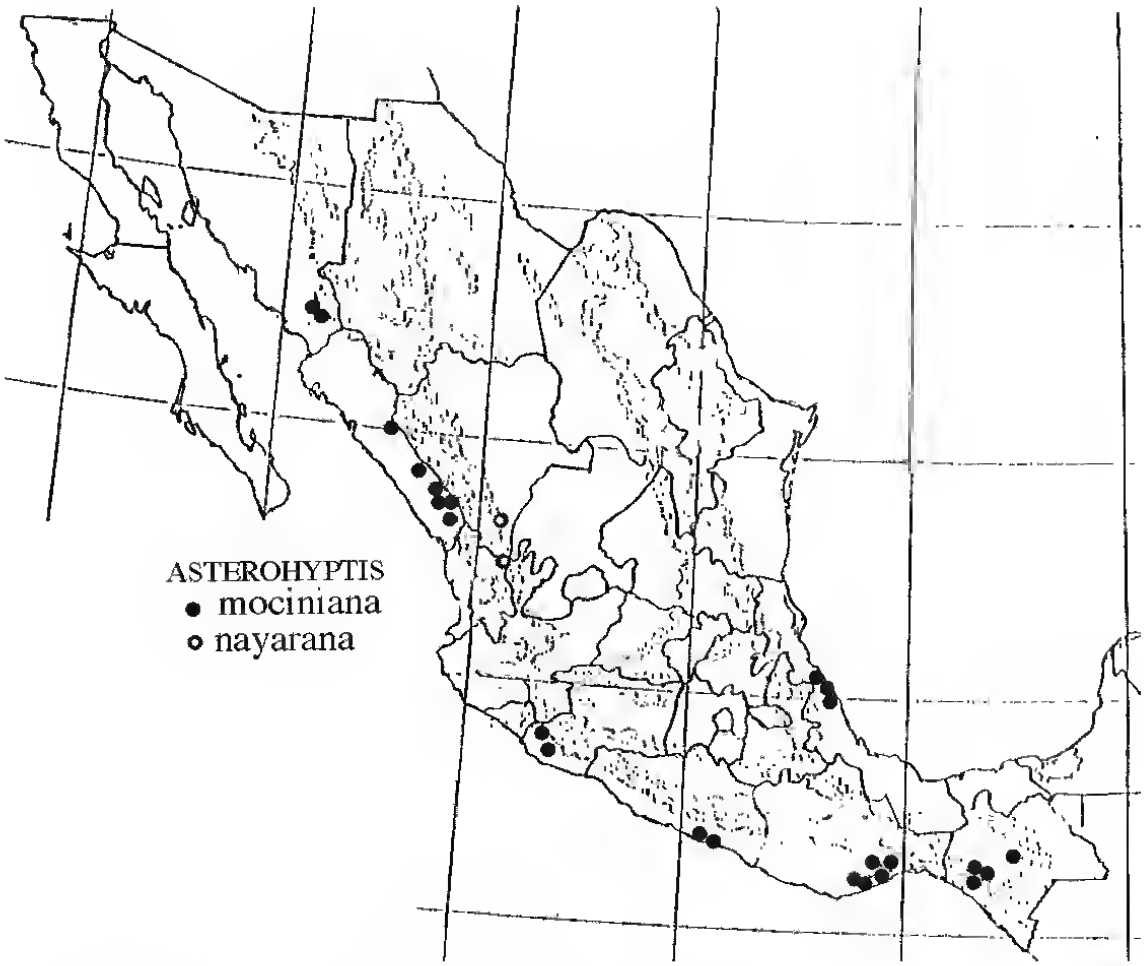
Figure 1. *Asterohyptis nayarana* (holotype).



Map 1. Distribution of *Asterohyptis stellulata*.



Map 2. Distribution of *Asterohyptis seemannii* and *A. nayarana*.



Map 3. Distribution of *Asterohyptis mociniana* and *A. nayarana*

Lance, R.W. 2011. New alignments in North American *Crataegus* (Rosaceae). Phytoneuron 2011-3: 1–8. Mailed 2 February 2011.

NEW ALIGNMENTS IN NORTH AMERICAN *CRATAEGUS* (ROSACEAE)

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ABSTRACT

New combinations are made for 30 southeastern USA *Crataegus* entities. The following varieties are designated: *C. alleghenensis* Beadle var. *extraria*, *C. allegheniensis* var. *ignava*, *C. alleghenensis* var. *mira*, *C. sororia* Beadle var. *segnis*, *C. sororia* var. *visenda*, *C. intricata* Lange var *biltmoreana*, *C. intricata* var. *fortunata*, *C. intricata* var. *horseyi*, *C. intricata* var. *padifolia*, *C. alabamensis* Beadle var. *florens*, *C. alabamensis* var. *ravenelii*, *C. alabamensis* var. *teres*, *C. lassa* Beadle var. *colonica*, *C. lassa* var *integra*, *C. lassa* var. *lanata*, *C. lassa* var. *recurva*, *C. munda* Beadle var. *pexa*, *C. quaesita* Beadle var. *egens*, *C. quaesita* var. *floridana*, *C. mollis* (Torr. & A. Gray) Scheele var. *dumetosa*, *C. mollis* var. *lamuginosa*, *C. mollis* var. *meridionalis*, *C. mollis* var. *texana*, *C. mollis* var. *viburnifolia*, *C. uniflora* Muench. var. *brittonii*, *C. pruinosa* (Wendl.) K. Koch var. *gattingeri*, *C. pulcherrima* W.W. Ashe var. *incilis*, *C. pulcherrima* var. *opima*, *C. sargentii* Beadle var. *gilva*, *C. venusta* Beadle var. *pallens*.
KEY WORDS: *Crataegus*, Rosaceae, new combinations, southeastern USA

In preparation for a forthcoming field guide to *Crataegus* of the southeastern USA, a number of new alignments are necessary to accommodate desired taxonomic concepts. These new alignments are proposed to consolidate minor morphological variation into infraspecific categories of wide-ranging species.

The proliferation of *Crataegus* species names in the early part of the 20th century, especially by Charles S. Sargent, William W. Ashe and Chauncey D. Beadle, occurred at a time when it was conventional to recognize relatively similar morphologies as distinct species. With subsequent study of the hawthorns of North America by later authors, the accuracy and stability of many of the species names became doubtful. The situation was rectified to some extent during intervening years by hawthorn specialists W.W. Eggleston, Jesse M. Palmer and Emil Kruschke, who published synonymy, new combinations, and infraspecific categories of many of the names, mostly of taxa occurring in the midwestern and northeastern USA. Especially in the southeastern USA, the use of infraspecific categories has lagged behind the trend and many of the original specific names of the early authors have been left unchanged due to obscurity, or they have been relegated to a broad synonymy that dismisses significant variation. In recent years, *Crataegus* series revisions by James B. Phipps have been the only detailed attempt by a specialist to investigate and reform the taxonomy of all southeastern *Crataegus*.

This paper is another attempt to bring aspects of southeastern USA *Crataegus* taxonomy to a level that is easily applied by field workers by combining a few examples of poorly known, related yet doubtfully distinct species into infraspecific categories. While genetic investigation of southeastern *Crataegus* is still in its infancy, new combinations based on morphology provide a hierarchy in the array of closely related taxa. Furthermore, several varietal or subspecific names have not been available for taxa whose similarities seem intuitive. This short paper proposes new taxonomic combinations at varietal rank for such taxa, based on observations and opinions of the

author after many years of field and herbarium study, and from considerable experience with hawthorn cultivation. A brief rationale accompanies each new combination.

The infraspecific rank of variety is used here mostly due to tradition, since in application to *Crataegus*, only the varietal category has made an appearance. Designation of varieties in this genus is wrought with similar concerns as with species rank, mainly the questionable extent of genetic uniformity due to a presence of polyploidy and apomixis. It is not precisely known how many of the named entities represent microspecies, morphospecies, nothospecies or compilospecies, but until this is revealed by further research, taxonomy based on morphology remains utilitarian. For the varieties proposed here, most have fairly broad ranges and represent a sufficiently distinct morphology within a species concept so that they are recognizable when sympatric with the typical species or any of its other varieties. The entities *horseyi*, *padifolia*, *pallens*, *lanuginosa*, *meridionalis*, and *viburnifolia* (here at varietal rank) represent regional, fragmented, or localized populations of a conspicuous morphology, yet their variation is minor when considered within a broad concept of the species. In all cases, rare intermediates may be encountered in mixed populations, but this is typical among any plant species with sympatric varieties and is not wholly indicative of a need for an overly expansive synonymy.

1. SERIES *APRICAE* J.B. Phipps

***Crataegus allegheniensis* Beadle group.** Several hawthorn species named by C.D. Beadle, spread among his groups *Euflavae*, *Ignavae*, and *Sororiae*, suggest a sufficiently close alliance that they may be regarded as one species complex. All of these are included as members of the new series *Apricae* by Phipps and Dvorsky (2007). The presence of variable stamen numbers but similar foliage morphology in this complex suggests that some or all may be derived from hybrid origins. Taking into account the oldest named member described in 1910, *C. allegheniensis* forms the core species.

Crataegus allegheniensis* Beadle var. *extraria (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus extraria* Beadle, Biltmore Bot. Stud. 1: 31. 1901. **LECTOTYPE** (Phipps & Dvorsky 2007): **Georgia**. Cobb Co.: Marietta, 11 September 1901, *C.D. Beadle 2485* (US).

This is a variant having 12 to 15 stamens per flower and a pilose-pubescent hypanthium, whereas the typical variety bears 10 stamens and a glabrous hypanthium. This variety seems fairly widely dispersed across the known range of *C. allegheniensis*.

Crataegus allegheniensis* Beadle var. *ignava (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus ignava* Beadle, Biltmore Bot. Stud. 1: 31. 1901. **LECTOTYPE** (Phipps & Dvorsky 2007): **Alabama**. DeKalb Co.: Lookout Mountain, Valley Head, Oct 1900, *C.D. Beadle 2289* (US).

This is a 20-stamen variant of the species, apparently of wide distribution based on recent collections.

Crataegus allegheniensis* Beadle var. *mira (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus mira* Beadle, Biltmore Bot. Stud. 1: 78. 1902. **TYPE** (Phipps & Dvorsky 2007): **Georgia**. Cobb Co.: 9 May 1901, *C.D. Beadle 4287* (holotype: US).

This variety differs from the typical variety by its wider leaf shape, more pubescent floral parts and 12–15 stamens. It is most similar to *C. allegheniensis* var. *extraria*, but anthers are frequently yellowish, rarely purplish as in the latter.

Crataegus sororia* Beadle var. *segnis (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus segnis* Beadle, Biltmore Bot. Stud. 1: 32. 1901. **LECTOTYPE** (Phipps & Dvorsky 2007): **Alabama**. Butler Co.: Greenville, 24 Aug 1901, *C.D. Beadle 2155* (A).

The typical variety is known by its tomentose pedicels, yellowish or pink anthers and broadly elliptic leaves having rather coarse serrations. The var. *segnis* bears less indumentum, purplish anthers and leaves of a more rhombic to obovate shape, finely or obscurely toothed. Its known range is south of the typical variety.

Crataegus sororia Beadle var. ***visenda*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus visenda* Beadle, Biltmore Bot. Stud. 1: 79. 1902. **LECTOTYPE** (Phipps & Dvorsky 2007): **Florida**. Liberty Co.: Bristol, 29 Mar 1901, *T.G. Harbison 4031* (A).

This variety is similar to var. *segnis*, but leaves are more often obovate or widest distally and the twigs and branches frequently droop. Its distribution is much wider than the other two varieties of *C. sororia* as treated here, adjoining the typical variety to the north and sympatric with var. *segnis* on the south. It also extends from Alabama and Florida to North Carolina, being the most wide-ranging representative of the species. This variety exhibits morphology approaching that of Series *Lacrimatae* J. B. Phipps, suggesting an alliance.

2. SERIES *INTRICATAE* (Sargent) Rehder

Crataegus intricata **Lange group.** The concept of *Crataegus intricata* Lange has been variously interpreted by floristicians, often inclusive of a rather extensive synonymy. Palmer (1946, 1950) initiated a more broadly defined concept for the species, followed by Kruschke (1965), who promoted the idea that more reduction in the taxonomy was due. That idea is continued here for a few southeastern representatives of the Series.

Crataegus intricata Lange var. ***biltmoreana*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus biltmoreana* Beadle, Botanical Gazette 28: 406. 1899. **TYPE: North Carolina**. Buncombe Co.: 10 August 1899, *Biltmore s.n.* (holotype US 981071).

The presence of hairs on young twigs and foliage and floral and fruiting parts is the only significant distinguishing trait separating *C. biltmoreana* from the normal range of variation accepted in *C. intricata*. Other related species, *C. boyntonii* Beadle, *C. neobushii* Sargent, and *C. rubella* Beadle, were treated as varieties of *C. intricata* by Kruschke (1965), as was *C. straminea* Beadle by Palmer (1950). All of these entities differ as much, or more, in their leaf morphology from the typical *C. intricata* as does *C. biltmoreana*, except in the realm of vestiture. This variety is sympatric with typical *C. intricata* across much of its range.

Crataegus intricata Lange var. ***fortunata*** (Sargent) R.W. Lance, comb. et stat. nov. *Crataegus fortunata* Sargent, Proc. Acad. Nat. Sci. Philadelphia. 62: 239. 1910. **TYPE: Pennsylvania**. Washington Co.: Charleroi, 7 October 1905, *O.E. Jennings 34* (holotype: A). Flowering specimens from the type locality, 21 May 1906, also are numbered *O.E. Jennings 34* (A).

The yellow fruit color of this plant, coupled with more subcoriaceous foliage and robust thorns than seen in typical *C. intricata* suggest that treatment at varietal rank is appropriate. The foliage characters are closest to those of *C. intricata* var. *rubella*, a variety with red fruit of oval or pyriform shape. Kruschke (1965) proposed the combination *C. intricata* var. *neobushii* (Sargent) Kruschke f. *fortunata* (Sargent) Kruschke, but he also noted a possible alternative affiliation of *fortunata* to *C. straminea* Beadle.

Crataegus intricata Lange var. ***horseyi*** (E.J. Palmer) R.W. Lance, comb. et stat. nov. *Crataegus horseyi* E.J. Palmer, Ohio J. Sci. 56: 211-212. 1956. **TYPE: Ohio**. Gallia Co.: Gallipolis, 13 May 1925, *R.E. Horsey 2247* (holotype: A 2569).

This entity may only be a localized version of *C. intricata*, possibly allied to *C. intricata* var. *rubella* (Beadle) Kruschke but with the distinction of finely serrate calyx margins and small (6-9mm), subglobose fruit. It is accepted here as a variety pending relocation and further study.

Crataegus intricata Lange var. ***padifolia*** (Sargent) R.W. Lance, comb. et stat. nov. *Crataegus padifolia* Sargent, Trees and Shrubs. 2:75. 1908. **LECTOTYPE** (Phipps et al. 2007): **Missouri**. Taney Co.: Swan, 24 April 1907, *B.F. Bush 5K* (A 261591).

Generally considered an endemic of the Ozark and Ouachita Mountain regions, this western member of *Intricatae* is distinguished in fruit by its nearly sessile calyx coupled with weakly lobed leaves. Other characters fall closely within the concept of *C. intricata*. The variety *C. padifolia* var. *incarnata* (Sarg.) bears closer resemblance to typical *C. intricata* in leaf shape and may represent an intermediate form, here relegated to synonymy.

3. SERIES *LACRIMATAE* J.B. Phipps

Crataegus alabamensis Beadle var. ***florens*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus florens* Beadle, Biltmore Bot. Stud. 1: 94. 1902. **LECTOTYPE** (Phipps & Dvorsky 2008): **Mississippi**. Lowndes Co.: Columbus, 25 Apr 1901, *T.G. Harbison 4176* (NY).

This variety exhibits sparse indumentum in its foliage and inflorescence parts, a departure from the typical variety, which has densely pubescent or tomentose pedicels and young leaves. The general morphology otherwise suggests a close affinity.

Crataegus alabamensis Beadle var. ***ravenelii*** (Sargent) R.W. Lance, comb. et stat. nov. *Crataegus ravenelii* Sargent, Bot. Gaz. 33: 122. Feb 1902. **LECTOTYPE** (Phipps & Dvorsky 2008): **Georgia**. Augusta, sand hills, 1901, *A. Cuthbert 411* (A).

The widespread *C. ravenelii* is placed as a variety of *C. alabamensis* due to foliage similarities. Phipps and Dvorsky (2008) placed it in synonymy with *C. condigna* Beadle, but in my opinion the type of *C. condigna* illustrates a smaller-leaved and possibly intermediate plant involving other species. The gradation of leaf serrations from small and near crenate to larger and more dentate parallels a range of vestiture between the more heavily pubescent *C. alabamensis* var. *alabamensis* on one hand, to extremes of glabrescence and toothing in *C. teres*, with *C. ravenelii* being intermediate in these features.

Crataegus alabamensis Beadle var. ***teres*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus teres* Beadle, Biltmore Bot. Stud. 1: 43. 1901. **LECTOTYPE** (Phipps & Dvorsky 2008): **Alabama**. Montgomery Co.: Montgomery, 15 Apr 1900, *C.D. Beadle 2169* (US).

This is the most extreme variety allied to *C. alabamensis*, as it is nearly completely glabrous. It is additionally distinct in its 2–3 styles (3–5 in the other varieties) but not so readily distinguishable through other morphology. It appears most similar to var. *florens*, which has hairs in its inflorescence.

Crataegus lassa **Beadle group.** The morphology used to distinguish the majority of Beadle's species that he placed in groups *Anisophyllae*, *Colonicae*, *Integrae*, *Michauxianae*, and *Recurvae* is here considered minor variation within one recognizable species complex. At the core of this complex is the earliest named entity having a suitable type, *C. lassa* Beadle of 1901. The most significant aspects of variation within this group are distinguished by recognition of 4 varieties.

Crataegus lassa Beadle var. ***colonica*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus colonica* Beadle, Biltmore Bot. Stud. 1: 104. 1902. **NEOTYPE** (Phipps & Dvorsky 2008): **South Carolina**. Beaufort Co.: Bluffton, June 1882, *J.H. Mellichamp s.n.* (A).

This variety is most recognizable by its abundant thorns, subentire leaf margins and pyriform fruits, characters considered here insufficient to support specific status.

Crataegus lassa Beadle var. ***integra*** (Beadle) R.W. Lance, comb. nov. *Crataegus flava* Aiton var. *integra* Nash, Bull. Torrey Bot. Club 22: 150. 1895. **LECTOTYPE** (Phipps & Dvorsky 2008: A): **Florida**. Lake Co.: vicinity of Eustis, 1-15 July 1894, *G.V. Nash 1142* (A; isolectotype US).

The leaf shape of this entity is slightly different from that seen in the species, more frequently bearing a pointed apex. Other morphology is barely useful in separation from a widened foliar concept of the species.

Crataegus lassa Beadle var. ***lanata*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus lanata* Beadle, Biltmore Bot. Stud. 1: 86. 1902. **LECTOTYPE** (Phipps & Dvorsky 2008): **Georgia**. Gwinnett Co.: near banks of Yellow R. below McGuire's Landing, 21 June 1899, *C.D. Beadle 587* (US).

This is a persistently white-pubescent variant of *C. lassa*. It also has more consistently lobed leaves than seen in the typical variety.

Crataegus lassa Beadle var. ***recurva*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus recurva* Beadle, Biltmore Bot. Stud. 1: 106. 1902. **LECTOTYPE** (Phipps & Dvorsky 2008): **Florida**. Marion Co.: Ocala, 20 August 1901, *C.D. Beadle 4007* (A).

The small (<10 mm diam.) fruits and obovate-spatulate leaves, usually 5–15mm wide and with an attenuate base and denticulate margin, account for the major distinction of var. *recurva*. This variety is easily recognizable in its most extreme forms, but intermediates may be encountered that suggest an unknown breeding complex.

Crataegus munda Beadle var. ***pexa*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus pexa* Beadle, Biltmore Bot. Stud. 1: 116. 1902. **LECTOTYPE** (Phipps & Dvorsky 2008): **North Carolina**. Rowan Co.: near Salisbury, 28 Apr 1897, *Biltmore Herbarium 300b* (US 981163).

Leaf morphology seems sufficiently similar, as do all other traits except longer thorn length, to fit this entity within *C. munda*. It represents a more northern variety in the range of the species, most common in the North Carolina Coastal Plain and extending into southeastern Virginia.

Crataegus quaesita Beadle var. ***egens*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus egens* Beadle, Biltmore Bot. Stud. 1: 85. 1902. **LECTOTYPE** (Phipps & Dvorsky 2008: GA): **Florida**. Liberty Co.: Bristol, 1 Apr 1901, *T.G. Harbison 4037* (GH; isolectotypes: A, US).

This variant exhibits smaller leaves than the species, but other traits suggest it has its closest alliance with *C. quaesita* or that it may be of hybrid origin. It is reasonably widely dispersed in the Coastal Plain.

Crataegus quaesita Beadle var. ***floridana*** (Sargent) R.W. Lance, comb. et stat. nov. *Crataegus floridana* Sargent, Bot. Gaz. 33: 124. Feb 1902. **LECTOTYPE** (Phipps & Dvorsky 2008): **Florida**. Duval Co.: Jacksonville, 18 Jul [no year], *A.N. Curtiss 8* (A).

This variety exhibits more blunt leaf lobing and nearly crenate serrations in its most extreme forms, but other traits suggest a close alliance with the species.

4. SERIES *MOLLES* (Loudon) Rehder

Numerous species in this Series have been described for the southeastern USA region that are closely related to, or perhaps merely variants of, the core species *Crataegus mollis* (Torr. & A. Gray) Scheele. The morphological variation used to separate these entities is not entirely stable, chiefly foliage shape and indumentum, anther color and the shape and color of fruit. The varieties presented here recognize significant segregates in the range of variation.

Crataegus mollis (Torr. & A. Gray) Scheele var. ***dumetosa*** (Sargent) R.W. Lance, comb. et stat. nov. *Crataegus dumetosa* Sargent, Rep. Missouri Bot. Gard. 19: 109. 1908. **LECTOTYPE** (Phipps et al. 2007): **Missouri**. Jasper Co.: Neck City, 31 March 1907, *E.J. Palmer* s.n. (A 16331).

This entity refers to plants with atypically elliptic and weakly lobed leaf shapes, which seem to be centered in the Missouri region.

Crataegus mollis (Torr. & A. Gray) Scheele var. ***lanuginosa*** (Sargent) R.W. Lance, comb. et stat. nov. *Crataegus lanuginosa* Sargent, Trees and Shrubs 1: 113. 1903. **SYNTYPES**: **Missouri**. Jasper Co.: Webb City, 2 Oct 1901, *C.S. Sargent 4* (A); **Missouri**. Jasper Co.: Carterville, Prosperity Junction, 19 May 1901, *B.F. Bush 543* (A).

This variety exhibits more copious foliar indumentum than the species, pink to rose anther color and is unknown outside of the small range of type specimens. Other traits used in its recognition are minor or inconsistent, as observed through cultivated examples. Natural populations having extant specimens have not been relocated for study.

Crataegus mollis (Torr. & A. Gray) Scheele var. ***meridionalis*** (Sargent) R.W. Lance, comb. et stat. nov. *Crataegus meridionalis* Sargent, Jour. Arnold Arb. 1: 252. 1920. **SYNTYPES**: **Alabama**. Hale Co.: Gallion, 17 April 1915, *T.G. Harbison 7* (A 16920); **Alabama**. Hale Co.: Gallion, 21 Sept 1915, *T.G. Harbison 7a* (A 16939).

This variety exhibits atypically narrow leaf shapes (often elliptic) that are also unlobed on floral shoots. The historic and known range of this taxon also is somewhat significant, being on the easternmost fringes of the coastal plain segment of the range of *C. mollis*. Until a more detailed evaluation can be done, which involves finding additional specimens, varietal status seems preferable to synonymy within *C. mollis* or specific recognition.

Crataegus mollis (Torr. & A. Gray) Scheele var. ***texana*** (Buckl.) R.W. Lance, comb. et stat. nov. *Crataegus texana* Buckley, Proc. Acad. Nat. Sci. Philadelphia 1861: 454. 1862. **TYPE**: **Texas**. Common on Brazos and Colorado Rivers, no date, *S.B. Buckley 161* [holotype: PH photo!].

There is sufficient variation within representatives of the *Molles* group in the southwestern range limits (particularly in Texas) that numerous species have received recognition based on characters such as anther color, stamen number, fruit color, indumentum, and shape of leaves. For the most part, this variation has been rated here as minor, partially due to an overlap of characters among these plants. A number of these named taxa (including *C. dallasiana* Sargent, *C. brazoria* Sargent) have sufficient morphological intermediacy that they are suspected of having hybrid origins, or perhaps they originated sporadically as forms among local, mixed populations of core *Molles* members. *Crataegus mollis* var. *texana* as considered here is a *Molles* entity having rose or red anthers and red fruit, occurring across the most extensive part of the Texas range of the group, differing from typical *C. mollis*, more limited in the same area, chiefly by anther color. The varietal designation considers that the *texana* plants may be seen as one of two regionally significant variations of a wide-ranging *C. mollis*, both forming perhaps the core taxa of a breeding complex that needs further genetic study.

Crataegus mollis (Torr. & A. Gray) Scheele var. ***viburnifolia*** (Sargent) R.W. Lance, comb. nov. *Crataegus viburnifolia* Sargent, Trees and Shrubs 2: 145. 1911. **TYPE**: **Texas**. Brazoria Co.: Columbia, 23 March 1909, *B.F. Bush & C.S. Sargent 11* (holotype: A). **EPITYPE** (Phipps 2007): **Texas**. Brazoria Co.: Columbia, common n woods, fruit canary yellow, 25 Sep 1901, *B.F. Bush tree 11=Bush 912* (A).

This variety differs from the species in its leaf morphology (large, coarse marginal serrations), fruit color (typically yellow or orange-blushed), and a restricted geographical range of portions of eastern Texas. Its anther color is normally white to yellowish, similar to that of the typical

variety. The latter trait distinguishes this variety from sympatric *C. mollis* var. *texana*, which has reddish anthers and also red fruit color. There is, however, some overlap in characters among individuals in mixed populations suggesting a reticulate breeding complex. Further work is needed to determine the origin and significance of closely related *C. brazoria* Sargent and *C. dallasiana* Sargent. An alternative viewpoint is suggested by Phipps (2007), designating *C. brazoria* Sarg. var. *viburnifolia* (Sargent) J.B. Phipps.

5. SERIES *PARVIFLORAE* (Loudon) Rehder

Crataegus uniflora Muench. var. ***brittonii*** (Eggleston) R.W. Lance, comb. et stat. nov. *Crataegus brittonii* Eggleston, Bull. Torrey Bot. Club. 36: 640. 1909. **TYPE**: **North Carolina**. Buncombe Co.: Biltmore, 15-18 Sept 1908, *W.W. Eggleston 4134* (holotype: NY; isotype: NY).

The principal differences used to distinguish var. *brittonii* have been leaf shape (more often semi-lobed and larger in size than the species) and greater height of the plant. Since *C. uniflora* has a wide range of variation relating to foliage and habit across its range (plants to 4m tall in Florida), the distinction of *brittonii* seems unremarkable when extreme leaf forms of *C. uniflora* are compared.

6. SERIES *PRUINOSAE* (Sargent) Rehder

Crataegus pruinosa (H.L. Wendl.) K. Koch var. ***gattingeri*** (W.W. Ashe) R.W. Lance, comb. et stat. nov. *Crataegus gattingeri* W.W. Ashe, J. Elisha Mitchell Sci. Soc. 17: 12. 1900. **LECTOTYPE** (Phipps 2007): **Tennessee**. Davidson Co.: Nashville, Sep 1880, *Dr. Gattinger s.n.* (MO).

The smaller anthers and more pronounced terminal leaf lobe seem to be the only significant difference between this plant and the range of variation normally seen in *C. pruinosa*. Despite this minor distinction, this is one of the few members of the *Pruinosae* that has not been previously assigned varietal status under a broadly interpreted *C. pruinosa* by other authors. Although a fairly well distributed southern member of the *Pruinosae*, there seems little defensible evidence to support its specific recognition.

7. Series *Pulcherrimae* (Beadle ex Palmer) Robertson

Of 22 published species in this series by Beadle, a majority are suggested to be sufficiently similar to the earlier-named *C. pulcherrima* W.W. Ashe that they can be relegated to synonymy within a broadened concept of that species. Two varieties are proposed here.

Crataegus pulcherrima W.W. Ashe var. ***incilis*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus incilis* Beadle, Biltmore Bot. Stud. 1: 41. 1901. **LECTOTYPE** (Phipps et al. 2006): **Alabama**. Autauga Co.: Evergreen, 12 Apr 1900, *C.D. Beadle 2143* (US 969493).

This variety bears more deeply lobed leaves and has a more slender, shrubby habit than the typical species.

Crataegus pulcherrima W.W. Ashe var. ***opima*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus opima* Beadle, Biltmore Bot. Stud. 1: 40. 1901. **LECTOTYPE** (Phipps et al. 2006): **Alabama**. Butler Co.: Greenville, 2 Oct 1900, *C.D. Beadle 2159/2* (US 981036; epitype NY).

The proportionally wider leaves with usually blunt lobing are the principal difference from the species. This variety extends farther west in the species range than other varieties, to eastern Texas.

Crataegus sargentii Beadle var. ***gilva*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus gilva* Beadle, Biltmore Bot. Stud. 1:60. 1902. **LECTOTYPE** (Phipps et al. 2006): **Alabama**. Marshall Co.: Albertville, rocky woods, Apr 1901, *T.G. Harbison 4374* (A).

The foliage of this variety exhibits very close similarity to the species, but is typically more shallowly lobed or unlobed.

Crataegus venusta Beadle var. ***pallens*** (Beadle) R.W. Lance, comb. et stat. nov. *Crataegus pallens* Beadle, Biltmore Bot. Stud. 1: 27. 1901. **LECTOTYPE** (Phipps et al. 2006): **North Carolina**. Buncombe Co.: Biltmore, upland woods, 14 May 1900, *Biltmore Herb. BC2* (US 969397).

This variety extends farther north, to western North Carolina, than other expressions of the species. Leaf, flower and fruit morphology align it with *C. venusta* rather than indicating that it is a distinct species or a synonym or variant of any other member of the *Pulcherrimae*.

ACKNOWLEDGEMENTS

I'm grateful to Tom Wieboldt for a review of the manuscript.

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Turner, B.L. 2011. *Osmorhiza geohintonii* (Apiaceae), a new species from Nuevo León, Mexico. Phytoneuron 2011-4: 1–4. Mailed 2 February 2011.

OSMORHIZA GEOHINTONII (APIACEAE), A NEW SPECIES FROM NUEVO LEÓN, MEXICO

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ABSTRACT

A new taxon, **Ozmorhiza geohintonii** B.L. Turner, sp. nov., is described from southern Nuevo León, Mexico. It is similar and apparently closely related to the widespread *O. mexicana* but is readily distinguished by a number of features including petal color, fruit shape and ornamentation, style length, and leaf glabrosity. A photograph of the type is provided, along with maps showing the distribution of the taxa concerned.

KEY WORDS: Apiaceae, *Osmorhiza*, Mexico, Nuevo León

Routine identification of Mexican plants has revealed the following novelty.

OSMORHIZA GEOHINTONII B.L. Turner, sp. nov., Figs. 1, 2.

Osmorhiza bipatriata Constance & Shan similis sed foliis glabris (vs. pubescentibus), petalis flavis (vs. albis), fructibus valde ornatis costis flavis elevatis (vs. laevibus nitidis sine costis elevatis), et ramis styli (stylopodio incluso) plerumque ca. 1.5 mm in longitudine (vs. 1 mm in longitudine vel brevioribus).

TYPE: **MEXICO.** Nuevo León. Mpio. Zaragoza, Cerro El Viejo, 2050 m, scattered plants, 0.5 m, 7 Jul 2007, *Hinton et al. 22116* (holotype: TEX). Fig. 1.

Perennial herbs, 40–50 cm high, glabrous. **Leaves** mostly basal, 10–15 cm long, 6–10 cm wide, bipinnately dissected, glabrous, the serrations acute at apices; petioles 4–8 cm long. **Flowers** 10–20, borne in terminal umbels, primary peduncles 8–16 cm long, secondary peduncles mostly 5, 3–5 cm long. **Pedicels,** glabrous, 2–3 mm long. **Petals** 5, obovate, ca 1 mm long, reportedly "yellow." **Anthers,** ca 0.5 mm long. **Style branches** (including stylopodium), ca 1.5 mm long, separate to base. **Fruits** linear to clavate, ca 1.5 cm long, 3–4 mm wide, not tapered at base (as in *O. mexicana*), espiculate, markedly ornate with raised yellow ribs, not at all glossy or shellacked (as in *O. bipatriata*).

ADDITIONAL SPECIMEN EXAMINED: **MEXICO.** Nuevo León. [Mpio. Zaragoza], below San Josecito, 2485 m, oak woods, 40 cm, thin colony, fl yellow, 31 Jul 1999, *Hinton et al. 27390* (TEX). Label data place this collection as from [Mpio.] "Aramberri," but the village of San Josecito is in Mpio. Zaragoza. George Hinton, after reading an advanced copy of this paper, confirmed my observations, but added this: "When my father and I went to Cerro Viejo I had no GPS so I had but a vague idea of where the collection was made. When I collected GBH 27390 I did have a GPS: 23º 55′ 40″ N, 99º 57′ 49.3″ W. It is very close to where I collected the types for *Verbesina tamanuevana*, *Gibasis hintoniorum*, and *Satureja hintoniorum*, and about 7.5 km from the type of *Acourtia hintoniorum*. A good place to collect!"

The holotype was annotated as *Osmorhiza mexicana* subsp. *bipatriata* (Constance & Shan) Lowry & Jones by Lincoln Constance in 1992-95 and as *O. bipatriata* Constance & Shan by James

Henrickson in 2005. The distinctions between these taxa, including *O. geohintonii* and *O. mexicana* Griseb., are outlined in the following key.

1. Fruits tapering to the base, the bodies to some extent spiculate ..... **Osmorhiza mexicana**
1. Fruits not tapering basally, spicules absent.

2. Petals white; styles (including stylopodium) 0.5–0.8 mm long; leaves to some extent pubescent ..... **Osmorhiza bipatriata**
2. Petals yellow; styles (including stylopodium) ca 1.5 mm long; leaves glabrous ..... **Osmorhiza geohintonii**

Constance and Shan (1948) first recognized *Osmorhiza bipatriata* at specific rank, typified by material from the Davis Mountains in trans-Pecos Texas; the taxon was subsequently treated as *O. mexicana* subsp. *bipatriata* by Lowry and Jones (1985). Wen et al. (2004), drawing upon DNA data, accepted its specific status, noting its relationship to be closer to *O. depauperata* Phil. as first noted by Yoo et al. (2002), who observed that *O. mexicana* and *O. bipatriata* do not form a monophyletic group.

Lowry and Jones (1985) cited four specimens of *Osmorhiza* subsp. *bipatriata* as occurring in Nuevo León on Cerro Potosí at relatively high elevations, two of these (*Mueller 2231* and *Schneider 1108*) thought to be "intermediate between *O. mexicana* subsp. *mexicana* and subsp. *bipatriata*." I take all of these Cerro Potosí collections to be specimens of *O. mexicana*, the specimens concerned bearing nearly espiculate fruits, although they otherwise fit well within the fabric of *O. mexicana*.

Distribution of the taxa is shown in Fig. 2, based upon specimens at LL-TEX and those cited in the paper by Lowry and Jones (1985).

ACKNOWLEDGEMENTS

I wish to thank Guy Nesom for the Latin diagnosis and providing helpful suggestions on the paper itself. Especially noteworthy has been the assistance of my colleague, Robert Harms, for his expert help with my computer problems.

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Figure 1. *Osmorhiza geohintonii* (holotype- TEX)

Figure 2. Distribution of the *Ozmorhiza mexicana* complex

Rolling, P.V., A. Howlett, and L.E. Brown. 2011. *Liriope muscari* and *Ophiopogon japonicus* (Ruscaceae) naturalized in Texas. Phytoneuron 2011-5: 1–5.

LIRIOPE MUSCARI AND *OPHIOPOGON JAPONICUS* (RUSCACEAE) NATURALIZED IN TEXAS

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ABSTRACT

Liriope muscari and *Ophiopogon japonicus* are reported here as naturalized in Texas. Both species are growing in bottomland woods in Jesse H. Jones Park on the northwest side of Humble, Harris County.

KEY WORDS: *Liriope muscari*, *Ophiopogon japonicus*, Texas, naturalized

Two species of liriopogons have become naturalized in Jesse H. Jones Park on the northwest side of Humble, Harris County, Texas. The park is at the end of Kenswick Drive. Documentation is provided here for the first time for the occurrence of *Ophiopogon japonicus* (Thunb.) Ker Gawl. and *Liriope muscari* (Dcne.) L.H. Bailey outside of cultivation in Texas.

Jesse H. Jones Park is over 300 acres in size and includes upland woods, bottomland woods and swamps, and riparian vegetation in the bottomland of Spring Creek. Both species are growing in bottomland woods, where heavy rains periodically flood the area. Presumably, they have become established in the park through dispersal of seeds from nearby residential neighborhoods. The naturalized plants are not close to horticultural plantings.

Ophiopogon japonicus (Figs. 1-3). The scapes are shorter than the leaves and the flowers are about 10 and nodding. The plants are colonial and expanding. Currently, the colony measures approximately four feet by four feet. The possible presence of the species in the Houston area (as shown by a photo of fruits on the Bayou Preservation Association website) was noted by Nesom (2010), but it previously has been documented in the USA only from Alabama (Spaulding et al. 2010).

Texas. Harris Co.: Jesse H. Jones Park, along Jones Bender Trail west of bridge (lat. 30.024222, long. -95.288800), N off of Hwy 1960 and W of the village of Humble, 11 June 2010, *Paul Roling s.n.* (SBSC).

Liriope muscari (Figs. 4-5). The *Liriope muscari* from the park has leaves 10+ mm wide, the scapes were definitely well beyond the leaves, and the couple of plants were in one tight clump of about one square foot. There were no flowers on the scapes, all having bloomed when found. The species has previously been reported outside of cultivation in the USA in Alabama, Georgia, Kansas, Louisiana, Maryland, Mississippi, and South Carolina (Nesom 2010).

Texas. Harris Co.: Jesse H. Jones Park, forest north of the North Branch of Jones Bender Trail, 0.5 of way between parking lot and bridge (lat. 30.024414, long. -95.289936), 27 Sep 2010, *Paul Roling s.n.* (SBSC).

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Figure 1. *Ophiopogon japonicus* colony.

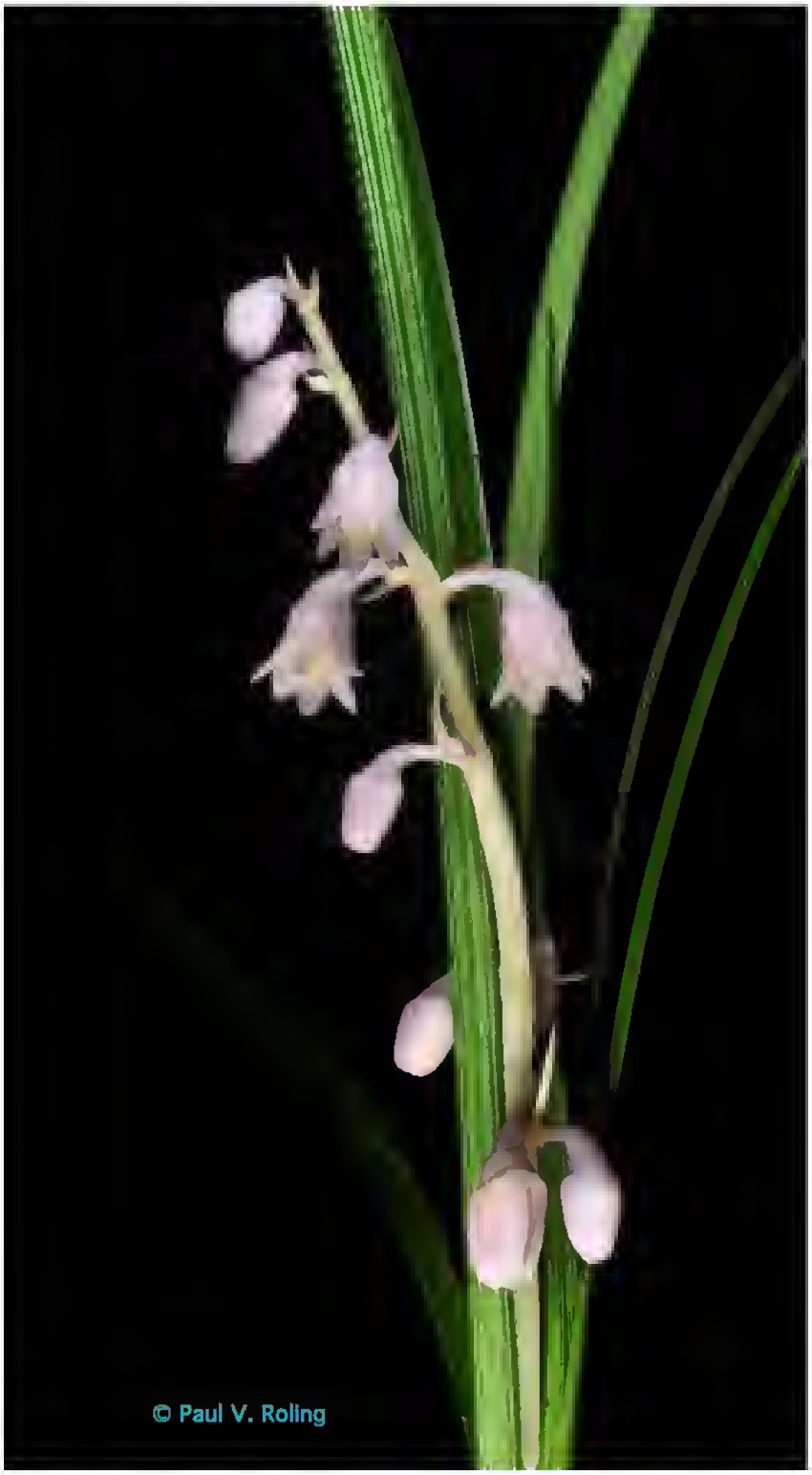

Figure 2 *Ophiopogon japonicus* scape in flower

Figure 3. Close-up of *Ophiopogon japonicus* flower.

Figure 4. *Liriope muscari* cluster in the woods.

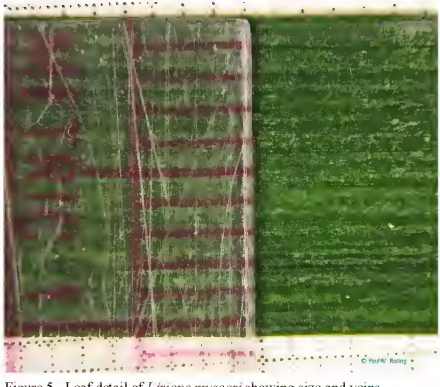

Figure 5. Leaf detail of *Liriope muscari* showing size and veins.

Holmes, W.C., J.R. Singhurst, and J.N. Mink. 2011. Heuchera americana (Saxifragaceae) in Texas. Phytoneuron 2011-6: 1–4.

HEUCHERA AMERICANA (SAXIFRAGACEAE) IN TEXAS

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ABSTRACT

The occurrence and distribution of *Heuchera americana* in Texas are clarified and expanded with documentation for five counties: Bowie, Cass, Harrison, Red River, and San Augustine. A distribution map and photo of a specimen from Harrison County are included.
KEY WORDS: *Heuchera*, Saxifragaceae, Texas, USA.

The purpose of this paper is to clarify and document the known distribution of *Heuchera americana* L. (Saxifragraceae) in Texas. The initial mention of the species in the state appears to be by Correll and Johnston (1970), who cited the distribution as northeast Texas. Hatch et al. (1990) cited the species as occurring in the Pineywoods, Post Oak Savannahs, and Blackland Prairies of the state, which was later referenced by Diggs et al. (1999) to include the species in their manual of the *Illustrated Flora of North Central Texas*. Johnston (1990) and Jones et al. (1997) also cited *H. americana* as occurring in the state. Turner et al. (2003) mapped the species as occurring in Bowie Co. Curiously, the PLANTS database (USDA, NRCS 2011), Wells (1984), and Wells and Shipes (2009) do not mention the occurrence of *H. americana* in Texas.

Although the species has frequently been cited as occurring in the state, we have not located a published record of a specimen citation for Texas. The following list of exsiccata documents the occurrence of *Heuchera americana* in five Texas counties: Bowie, Cass, Harrison, Red River, and San Augustine (Fig. 1). We are including all collections because of the rarity of the species in Texas herbaria. The Harrison Co. specimen (*Correll & Lundell 18785*, SMU), the oldest Texas collection of the species located, is shown in Fig. 2.

Specimens cited: **TEXAS. Bowie Co.**: On wooded bluff along Rte. 559, 1 mile north of Wamba, 30 April 1969, *Correll 37142* (LL); above waterworks Lake, just NE of Wamba, hardwood slopes, 13 Jul 1965, *Correll 31281* (LL); Bringle Lake, a mesic white oak-chinquapin oak forest; fls cream, 15 April 2000, *Holmes, Singhurst, & Baldridge 10831* (BAYLU, TEX); Bringle Lake, 1.4 mi. NE of Wamba,

City of Texarkana property, 10 May 2000, *Singhurst 8856* (BAYLU); north of Wamba; very steep, wooded slopes, May 1978, *Ajilvsgi 7340* (BRIT). **Cass Co.**: Nature Guided Trail, Atlanta State Park, 12 May 1999, *Holmes & Singhurst 9998* (BAYLU). **Harrison Co.**: on rich wooded slope of ravine along Cypress Bayou, below small roadside park near Jefferson, 23 May 1958, *Correll & Lundell 18785* (SMU). **Red River Co.**: Mrs. Joe Swindle's land, NE of Woodland Cemetery ca. 0.4 mi. near Woodland Community, headwater springs of Tanyard Creek, Cretaceous Woodbine Formation outcrop at merger with lower Eagleford Shale, 1 April 2000, *Singhurst & Swindle 7903* (BAYLU). **St. Augustine Co.**: Sabine National Forest, Compartment 65, Cypress Creek, calcareous seep slope forest on Weches outcrop, 24 April 2002, *Singhurst 11155* (BAYLU).

The San Augustine station is approximately 240 km south of the only previously known records in Bowie Co. All of the Bowie Co. specimens are from the Bringle Lake area (a reservoir impounded in 1929) that has been heavily impacted by recent construction of a golf course and formation of Texas A&M University–Texarkana, with other development planned or in progress. *Heuchera* is considered to be a peripheral species in Texas, the distribution being continuous with that of Oklahoma, Arkansas, and Louisiana. It is of conservation concern (S1, with 6 or fewer populations, rare within Texas).

Within the state, the species occurs in hardwood forests growing on calcareous substrates subject to wet season seepage. Generally these forests are located at the base of slopes or on horizontal benches on slopes. Typical overstory trees include *Quercus alba*, *Carya tomentosa* (= *Carya alba*), *Acer rubrum*, *Fraxinus americana*, and *Carpinus caroliniana*. Understory woody vegetation consists of *Lindera benzoin*, *Itea virginica*, *Alnus serrulata*, *Viburnum rufidulum*, and immature specimens of the overstory vegetation. Associated herbaceous vegetation includes *Polystichum acrostichoides*, *Athyrium felix-femina* subsp. *asplenioides*, *Packera obovata*, *Carex* spp., and *Tipularia discolor*.

Correll and Johnston (1970) referred the Texas specimens of *Heuchera americana* to var. *brevipetala* Rosendahl, Butters, & Lakela, which was treated by Wells and Shipes (2009) as *H. americana* var. *americana*. All Texas specimens examined are referable to *H. americana* var. *americana*.

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The authors are greatly indebted to Tiana Franklin of the Botanical Research Institute of Texas (BRIT) in Fort Worth for providing digital photographs of specimens of *Heuchera americana*. Information on *H. americana* specimens from TEX/LL was acquired from the Flora of Texas Database (http//www.biosci.utexas.edu/prc/Tex.htm/), Plant Resources Center, The University of Texas, Austin.

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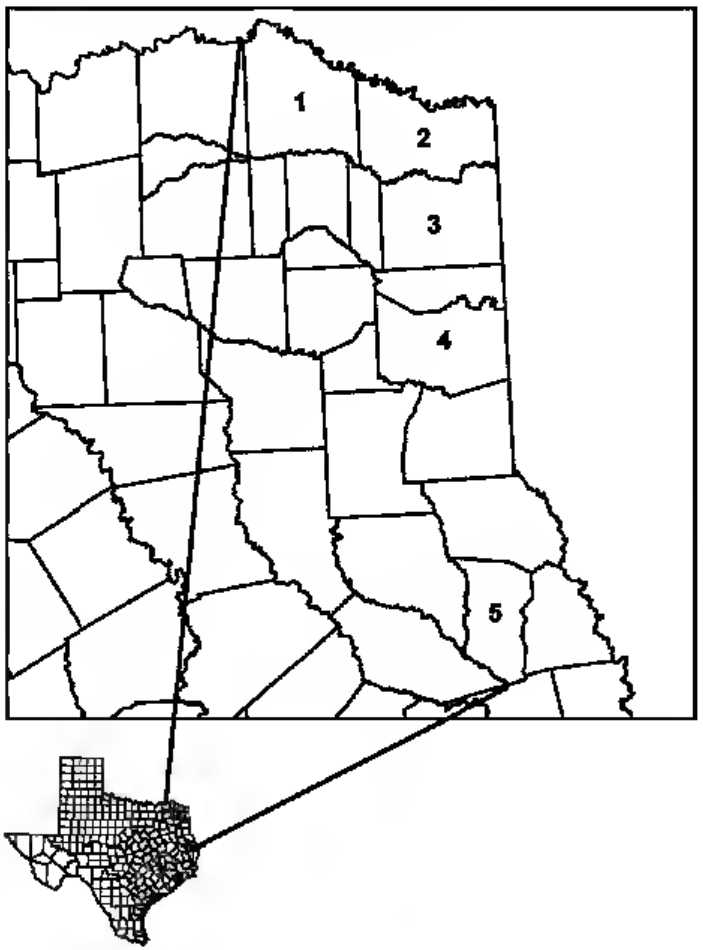

Figure 1. Distribution of *Heuchera americana* in Texas. The numbers are in counties in which the species has been documented: 1, Red River; 2, Bowie; 3, Cass; 4, Harrison; and 5, San Augustin.

Figure 2. *Correll & Lundell 18785* (SMU), from Harrison Co., Texas; the oldest *Heuchera americana* specimen from the state located during the study. Used with permission of BRIT Virtual Herbarium. Atrium Biodiversity Information System, Botanical Research Institute of Texas. http://atrium.brit.org. Accessed 11 Feb 2011.

Turner, B.L. 2011. A new gypsophilic *Mentzelia* (Loasaceae) from Nuevo León, Mexico. Phytoneuron 2011-7: 1–3. Mailed 21 Feb 2011

A NEW GYPSOPHILIC *MENTZELIA* (LOASACEAE) FROM NUEVO LEÓN, MEXICO

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ABSTRACT

Mentzelia gypsophila B.L. Turner, sp. nov., is described from gypseous soils near Mina, Nuevo León and Viesca, Coahuila. It is clearly closely related to *M. lindheimeri* Urb. & Gilg but differs in its annual habit, smaller flowers, and fewer stamens. A photo of the holotype is provided along with a distribution map of the two species concerned.

KEY WORDS: Loasaceae, *Mentzelia*, Mexico, Coahuila, Nuevo León

Routine identification of Mexican plants has brought to focus another previously undescribed species from the gypsum outcrops of northeastern Mexico.

Mentzelia gypsophila B.L. Turner, sp. nov. Fig. 1.

Mentzeliae lindheimeri Urb. & Gilg similis sed differt duratione annua (vs. perenni), floribus minoribus (petalis 5–6 mm longis vs. plerumque 8–15 mm), et staminibus paucioribus (10–20 vs 25 vel plus).

TYPE: **MEXICO. Nuevo León.** Mpio. Mina, northeast of Carricitos, gypsum ravine, 981 m, 17 Oct 2008, *Hinton et al. 28784* (holotype: TEX).

Annual herbs, 10-50 cm high. **Mid-stems** with spreading, both spiculate and espiculate, trichomes 0.2–0.8 mm long, these underlain by a vestiture of much more numerous shorter hairs ca. 0.1 mm high; petioles 0.5–2.5 cm long; blades ovate, irregularly serrate or lobed, moderately appressed-pubescent on both surfaces. **Flowers** mostly axillary along upper stems, sessile or nearly so. **Calyces** (flowering) 5–12 mm long; sepal lobes lanceolate, 5–6 mm long, pubescent like the stems. **Petals** 5–6 mm long, reportedly "yellow" or "orange." **Stamens** 10–20, ca 6 mm long; anthers yellow, ca 0.5 mm long. **Capsules** ca 1.5 cm long, 0.5 mm wide. **Seeds** obtrapezoidal, ca 2 mm long, 1.5 mm wide, markedly rugose, the surfaces ornamented throughout with parallel ridges.

Additional specimens examined: **MEXICO. Coahuila.** Mpio. Viesca, E of 5 de Mayo, 25.05157 N, 102.29176 W, gypsum ravine, 1508 m, 1 Oct 2006, *Hinton et al. 28508* (TEX-2 sheets).

Except for its seemingly annual habit and duration and smaller flowers, the present novelty much resembles *Mentzelia lindheimeri* Urb. & Gilg (including *M. texana* Urb. & Gilg; Turner 2002). At least six of the plants included in the type collection (Fig. 2) have delicate tap roots, these very unlike the woody tap roots of *M. lindheimeri.*

1. Annual; petals 5–6 mm long; stamens 10–20 ..... *Mentzelia gypsophila*
1. Perennial; petals mostly 8–15 mm long; stamens 25 or more ..... *Mentzelia lindheimeri*

According to Correll and Johnston (1970), *Mentzelia texana* (included within *M. lindheimeri* by my taxonomy) has petals 6-8 mm long and 25 stamens, but I was unable to confirm the shorter petals among the numerous specimens at LL-TEX. Indeed, my examination of 16 specimens of *M.*

lindheimeri from Mexico at LL-TEX showed the petals to vary from 8–15 mm in length and the stamens to be 30 or more. More telling, all of the Mexican sheets had strong, perennial taproots and none was collected on gypseous soils, so far as known.

The restriction of *Mentzelia gypsophila* to gypseous soils is especially noteworthy, hence its name. The type locality is well known for its edaphic endemics (Turner 2008). Distribution of the two taxa is shown in Fig. 2.

ACKNOWLEDGEMENTS

I am grateful to my colleague Guy Nesom for the Latin diagnosis and for helpful comments on the paper itself. Distribution maps (Fig. 2) are based upon specimens on file at LL-TEX.

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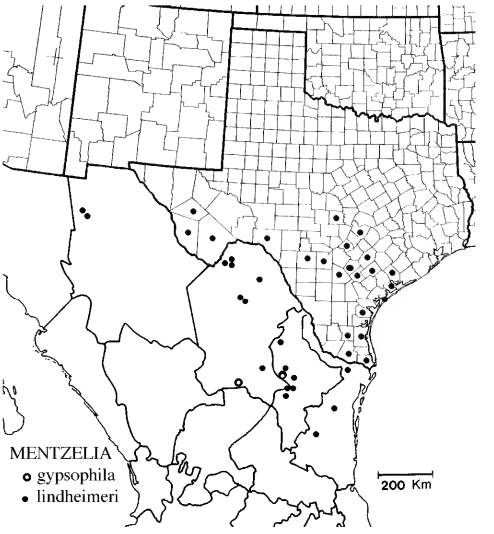

Figure 1. Distribution of *Mentzelia gypsophila* and *M. lindheimeri*.

Figure 2. Holotype of *Mentzelia gypsophila*.

FRUGIVORY IN *DIRCA* (THYMELAEACEAE) AS A METHOD OF SHORT-DISTANCE DISPERSAL

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ABSTRACT

Dispersal in *Dirca* remains relatively understudied, with only minimal data on hydrochory and no data supporting a hypothesis of bird dispersal. Observations are presented that suggest frugivory, as evidenced by rodent seed caches, as a mechanism for short-distance dispersal in *Dirca*.
KEYWORDS: *Dirca*, rodent, frugivory, endochory, dispersal

Given the close association of *Dirca* L. species with riparian systems, it has been assumed that a major mechanism for their dispersal is hydrochory (Nevling 1962; Ward & Horn 1998; Williams and Moriarity 1998; Floden 2009; Williams 2009). Recently, hydrochory was tested as a method of seed distribution for *D. palustris* L. and it was determined that the buoyancy time for the species does not support hydrochory as the predominant method for dispersal (Williams 2009). Seemingly in contrast to this observation, the distribution of *D. palustris* in the southernmost part of its range is largely confined to riparian systems (Floden et al. 2009; Schrader & Graves 2004; Ward & Horn 1998).

Phylogeographic analyses of *Dirca palustris* might support hydrochory as the primary mode of long-distance dispersal, based on the genetic structure of the populations. Gravity as a method for dispersal, however, is indicated by the number of randomly scattered seedlings under individuals in cultivation and in situ. Nevling (1962) suggested bird distribution as a mechanism for dispersal, but the fruits do not ripen red to signal maturity, nor is there any evidence yet that supports this (Floden et al. 2009).

Frugivory has been suggested as a likely short-distance dispersal mechanism, as evidenced by multiple seedlings growing from a relatively small area, which suggests rodent caches of seed (Ward & Horn 1998) but direct evidence in support of this hypothesis has been lacking. Observations of shrubs at the type locality for *Dirca decipiens* Floden during fruit maturation suggest rodent endochory, as the majority of fruits from a shrub are promptly removed nocturnally when the first drupes mature. Maturity of the fruit is signaled by a slight shift in color from green to pale yellow on the apices sequentially from the top down; light pressure will cause mature fruit to drop (Ward & Horn 1998; Schrader & Graves 2005; Graves 2008; Floden et al. 2009). Evidence of seed predation was observed as pericarp remnants beneath the shrubs, but no uneaten seeds were observed.

Observations in 2010 by the author of a population of *Dirca decipiens*, near its type locality but established in the garden of my parents, found evidence of multiple rodent seed caches under rocks and under heavy leaf litter (Figs. 1 and 2). Each cache consisted of many uneaten seeds but an even larger quantity of pericarp remnants. Additionally, uneaten seeds of previous year's seed caches were evident, with multiple seedlings germinating in large numbers (5–15) from individual locations, which would preclude the natural ripening and abscission of fruits from the shrubs. This supports the suggestion by Ward and Horn (1998) that frugivory is a possible method of seed dispersal.

In the western *Dirca occidentalis* A. Gray, little evidence of frugivory was noted and none of that definitive (Schrader & Graves 2008). Evidence of the effectiveness of frugivory vs. seed predation as shown by seed caches should be explored further in each species to determine the extent short-distance dispersal plays in distribution, while molecular analysis may clarify the role of hydrochory as a method of long-distance dispersal.

ACKNOWLEDGEMENTS

I thank Dr. B.E. Wofford and Dr. Guy Nesom for their reviews and suggestions on the manuscript.

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Figure 1. Portion of cache of *Dirca decipiens* seeds, showing possible effects of frugivory. Whole fruits ca. 1 cm long.

Figure 2. Cache of *Dirca decipiens* seeds.

Floden, A. 2011. *Trautvetteria caroliniensis* (Ranunculaceae), new to Texas from a historical collection. Phytoneuron 2011-9: 1–2.

TRAUTVETTERIA CAROLINIENSIS (RANUNCULACEAE), NEW TO TEXAS FROM A HISTORICAL COLLECTION

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ABSTRACT

Trautvetteria caroliniensis is documented to occur in Smith County, Texas; a southwestern range extension of ca. 300 km from Garland County, Arkansas. This is the westernmost known occurrence of *T. caroliniensis*.
KEYWORDS: *Trautvetteria*, Texas

During examination of *Trautvetteria* exsiccatae at MO, two sterile specimens were discovered from a historical collection by J. Reverchon. The sheets were originally identified as a *Sanicula* species but later identified as *Trautvetteria caroliniensis* (Walt.) Vail by M.E. Mathias, still later re-annotated by T. Shimizu confirming that identification.

USA. Texas. [Smith Co.]: Lindale, 23 Apr 1901, *J. Reverchon s.n.* (MO-2 sheets).

This collection documents at least a historical southwestward and eastern range extension from the opposing ends of the range of the genus.

Populations of *Trautvetteria* taxa are distributed in three disjunct regions in North America: the eastern United States, the southwestern US in Arizona, Colorado, New Mexico, and Utah, and along the northern Pacific Coast. In eastern North America *T. caroliniensis* occurs from Pennsylvania south to Florida and west to Arkansas, albeit its occurrence is highly scattered west of the Cumberland Mountains and Interior Low plateau. The species is known only from a single site in Garland County, Arkansas. In Missouri it is limited to a single county. It is assumed extirpated in Indiana (Parfitt 1997) and is also likely extirpated in Illinois. This southwestern range extension brings the distribution of *T. caroliniensis* nearer to the western *T. grandis* Nutt., a taxon subsumed within a broad circumscription including all variation within a monotypic genus (Parfitt 1997; Shimizu 1981).

The specific boundaries between *Trautvetteria* taxa have been based on leaf, utricle, and filament morphology (Greene 1912; Rydberg 1917). Shimizu (1981) placed all taxa including the sole Asian taxon in synonymy with *T. caroliniensis*, but within geographically defined subtaxa. Parfitt (1997) commented that the varietal differences seem rather arbitrary and geographical delimitation of subtaxa unwarranted. In contrast to this opinion, molecular evidence supports the recognition of at least three taxa: *T. caroliniensis*, *T. grandis*, and *T. japonica* Sieb. & Zucc. (Xiang et al. 1998; Xiang & Soltis 2001). Leaf morphology is distinct within these molecularly supported species. Value of utricle and filament morphology remains uncertain in species classification. The Texas specimens show the coarsely serrate leaf margins and lobing of *T. caroliniensis* rather than the crenately margined populations of *T. grandis* in the Mogollon Mountains, NM, previously classified as *T. media* Greene.

Whether *Trautvetteria carolinienses* is still extant in east Texas remains to be discovered. Its habitat preference is cool stream margins in calcareous sites and suitable habitats presumably exist to the north along the Sabine River. Flowering plants of *Trautvetteria* are usually conspicuous with corymbose inflorescences of apetalous flowers but with showy white stamens resembling some species of *Thalictrum*. Anthesis usually occurs between mid-June and early August.

Attention should also be brought to field taxonomists to populations in southern Georgia in the Coastal Plain that were named *Trautvetteria nervata* Greene (isotypes at NY, MO, and US; habitat as "rich damp open woods, Dublin,"). This morphotype exhibits highly distinctive leaf morphology — each leaf is divided into three lobes and each lobe further divided over halfway into three lobules, with the outer two lobes inner lobule divided once more with none of the lobules more than 2 cm wide, in effect, resembling a large, coriaceous, basal leaf of *Delphinum*.

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A NEW COMBINATION IN *GORDONIA* (THEACEAE)

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ABSTRACT

The name *Laplacea brenesii* Standl. (Theaceae) is confirmed as a synonym of *L. grandis* Brandegee, the latter replaced by *G. brandegeei* H. Keng, nom. nov. (not *G. grandis* André 1880). As a consequence, *Gordonia brenesii* (Standl.) Q. Jiménez, comb. nov. (here validated), must replace *G. brandegeei* as the accepted name for the species involved.
KEY WORDS: *Gordonia*, *Laplacea*, Theaceae

Laplacea grandis Brandegee (1915: 186) is the earliest known name for an arborescent species of Theaceae ranging throughout the Mesoamerican region, and was used as the accepted name in the most recent taxonomic revision in which that species was included (Kobuski 1950). The same species was treated in full under the name *L. grandis* in the *Flora of Panama* (Robyns 1967), and mentioned by that name in the *Flora of Guatemala* (Standley & Williams 1961: 32). However, in uniting *Laplacea* Kunth (in Humboldt et al., 1822: 207) with *Gordonia* J. Ellis (1771: 520), Keng (1980: 310) replaced *L. grandis* with a nomen novum, *Gordonia brandegeei* H. Keng, citing *G. grandis* André (1880: 60) as a blocking name. The name *Gordonia brandegeei* has since been employed as an accepted name in at least one major floristic treatment (Pool 2001), several regional checklists (e.g., Correa et al. 2004; Linares 2005), and many herbaria.

Keng's (1980) new names and combinations for New World species almost certainly did not involve any original taxonomic work but rather were based on Kobuski's (1950) revision, which was duly cited. But Keng did not take into account Kobuski's inclusion of the validly published *Laplacea brenesii* Standl. (1937) in synonymy under *L. grandis*. It seems most likely that Keng believed that a nomen novum assumes the priority of the name it replaces (a common misconception, in our experience). However, it is also possible that Keng simply overlooked this detail, or he rejected *L. brenesii* as a synonym of *L. grandis*; we cannot be certain, because Keng nowhere mentioned the name *L. brenesii*. Nevertheless, it is clear that, if *Laplacea brenesii* is indeed a taxonomic synonym of *L. grandis*, then a combination based on the former name must replace *Gordonia brandegeei* as the correct name for the species in the genus *Gordonia*.

We have examined an image of the holotype specimen (*Brenes 4379*, F) of *Laplacea brenesii* posted by the Field Museum Department of Botany at the following Internet address:

http://emuweb.fieldmuseum.org/botany/vtypeDisplay.php?irn=257085&QueryPage=%2Fbotany%2Fsearch_vtype.php

This image is immediately verifiable by us as depicting the species that has lately been known as *Gordonia brandegeei*. Moreover, the specimen bears a 1991 annotation by Anna L. Weitzman (US), a contemporary Theaceae specialist, recording the same identification. And finally, not wishing to take anything for granted, we have confirmed both of these identifications by examining an image of the holotype of *Laplacea grandis* (*Purpus 7092*, UC), posted by the UC and JEPS herbaria at the following Internet address:

http://ucjeps.berkeley.edu/cgi-bin/display_smasch_img.pl?smasch_accno=UC174218

We therefore conclude that *Laplacea brenesii* is indeed a taxonomic synonym of *L. grandis*, as originally indicated by Kobuski (1950). The combination of the former name in *Gordonia* is thus validated below, and the consequent synonymy is formalized.

Gordonia brenesii (Standl.) Q. Jiménez, comb. nov. Basionym: *Laplacea brenesii* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 18(2): 701. 1937. **Type: Costa Rica**. [Alajuela:] Los Ángeles de San Ramón, 1050 m, 21 Aug 1925, *A.M. Brenes 4379* (holotype: F-852413, image!; IT: CR).

Gordonia brandegeei H. Keng, Gard. Bull. Singapore 33: 310. 1980. Replaced name: *Laplacea grandis* Brandegee, Univ. Calif. Publ. Bot. 6: 186. 1915 (non *Gordonia grandis* André, 1880: 60). **Type: Mexico**. Chiapas. Finca Mexiquito, Jul 1913, *C.A. Purpus 7092* (holotype: UC-174218, image!).

It should be emphasized that, although we now regard *Gordonia brandegeei* H. Keng as a synonym of *G. brenesii*, the former name is not illegitimate, because Keng (1980) did not explicitly include *Laplacea brenesii* as a synonym. Thus the name *G. brandegeei* remains available and could theoretically come back into use, were the types of *Laplacea brenesii* and *L. grandis* judged to represent different species.

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Mink, J.N., J.R. Singhurst, and W.C. Holmes. 2011. *Dryopteris celsa* (Dryopteridaceae) and E.J. Palmer 29404: Solution of a Texas mystery. Phytoneuron 2011-11: 1–8.

DRYOPTERIS CELSA (DRYOPTERIDACEAE) AND *E.J. PALMER 29404*: SOLUTION OF A TEXAS MYSTERY

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ABSTRACT

A study of the specimens of *E.J. Palmer 29404* from Bowie County, Texas, validates the occurrence of *Dryopteris celsa* in Texas and discloses that the specimens are mixed in various combinations with *Osmunda cinnamomea* (Osmundaceae).
KEY WORDS: *Dryopteris*, Dryopteridaceae, *Osmunda cinnamomea*, Osmundaceae, Texas, E.J. Palmer.

Dryopteris taxonomy has been problematic in Texas, although the genus is represented by only five species (Mink et al. 2010). This has been caused by several factors, one being the difficulty in delineating the genus *Dryopteris* from *Thelypteris*. For example, Gould (1962) included eight species of *Dryopteris* in his checklist of Texas plants. Of these eight, only *D. felix-mas* (L.) Schott, is presently known to occur in the state. The other species are now placed in *Thelypteris* or its segregates. Also complicating the systematics have been an underestimation of geographic distributions (e.g. *Dryopteris celsa* by Small 1938) as a result of misidentification (as discussed here) and the occurrence of hybridization within the genus.

The North American species of *Dryopteris* are widely distributed throughout northern temperate areas and freely hybridize (Wagner 1971; Walker 1962). These hybrid relationships are well-established (e.g., fertile and sterile crosses) and acknowledged (Wagner 1943), but this hybridization intensifies the difficulty and complexity of species identification in the field (Wagner & Musselman 1979; Lellinger 1985; Montgomery & Wagner 1993; Peck 2000). Despite fair understanding of hybrid relationships, identification of hybrid *Dryopteris* has confused definitive confirmation of distinctive morphological characters and subsequent nomenclature of the genus. Although no species of *Dryopteris* were described from Texas vouchers, parent taxa names were imported from areas where hybridization was common. This hybridization is relevant to the Texas fern flora because names of various fertile tetraploids (e.g., *D. celsa* and *D. cristata*) were reflected in the identification of historic Texas collections by reference to more eastern and northern taxa (i.e., *D. cristata*). Fertile tetraploids ultimately have become recognized as part of the modern Texas flora (e.g., *D. celsa* and *D. ludoviciana*), even though parental taxa do not occur in the state.

Inclusion of *Dryopteris cristata* (L.) A. Gray in Texas and controversy regarding the presence or absence of *D. celsa* (W. Palmer) Knowlton, W. Palmer, & Pollard in Texas is primarily associated with interpretation *E.J. Palmer 29404* (GH, MO, UMO), which was collected along "Margins of sandy bog, near Texarkana, Bowie County, Oct. 27, 1925." The specimen was determined to be *D. cristata* (in part) by Correll (1956). This determination was included in the floristic account by Correll and Johnston (1970, 1972) and Correll and Correll (1972). Complicating the identification has been the mixed nature of these specimens, which is the subject of this paper. Two of the specimens distributed under this number are now known to be a mixture of *Osmunda cinnamomea* L. and *D. celsa*.

For this study, four herbarium sheets of *Palmer 29404* were located — two at MO and one each at UMO and GH. The MO and UMO specimens were received on loan, while the GH specimen was studied from a high resolution digital image. The original labels of all four sheets identified the ferns as *Osmunda cinnamomea*.

The UMO sheet (Fig. 1) contains one frond, identifiable as sterile *Osmunda cinnamomea* by the cinnamon colored woolly hairs in the axils of the pinnae. As written on the sheet, the specimen was from the herbarium of E.J. Palmer and was a gift to the University of Missouri. There are no annotations on this sheet. Since this was in the collector's personal herbarium, it is presumed to be the "best" sheet and suggests that *O. cinnamomea* was the object of the collection. This was confirmed by reference to Palmer's field notebook, where he indicated that *29404* is *O. cinnamomea* (R.C. Kennedy, pers. comm.). This specimen may be involved with circumstances surrounding the exclusion of *Dryopteris celsa* from Texas in the Flora of North America (Montgomery & Wagner 1993).

Two sheets of *Palmer 29404* are housed at MO (Figs. 2, 3). MO 925450 has a sterile *Osmunda cinnamomea* frond, identified by the cinnamon colored hairs at the bases of the pinnae and more or less entire margins of the pinnae. MO 2139996 consists of a sterile frond of *Dryopteris celsa*, which is distinguished from *Osmunda* by the brownish to tan triangular scales at the base of the stipe and pinnules, serrated margins of the pinnae, and presence of foveolae near the margins of the upper surface of the leaf. The vein in the foveola is swollen into a clavellate shape of ca. 0.2 mm long and ends before reaching the margin. Several lines of evidence indicate that these two specimens once constituted a single sheet: conventional practice would prohibit two sheets of the same number (or specimen) sent to the same place in exchanges; the label of MO 2139996 (*D. celsa*) is photocopied, as determined by the "toner" nature of the print, abundance of toner specking over the surface, and lack of impact type impressions found on the labels of the other sheets distributed under this number; the label is smaller in size (10.7 × 5.9 cm vs. 10.8 × 7 cm) than the labels of other specimens with this number; and the higher accession number of the *Dryopteris* sheet, which is suspicious. That these two specimens were originally mounted on a single sheet is confirmed by Correll's (1956) statement:

> "A frond of this species [*Dryopteris cristata*, a misidentification of *D. celsa*] is mounted with a frond of *Osmunda cinnamomea* on sheets in the Herbarium of the Missouri Botanical Garden and the Gray Herbarium. Although an error in mounting the specimens on the herbarium sheets might have occurred, the fact that two sheets in two different herbaria, labeled "*Osmunda cinnamomea*," each have a frond of this species and of *cinnamomea* would not appear to substantiate this assumption. It appears more likely that the mixture of fronds of the two species was obtained in the field and was distributed accordingly" (pp. 151–153).

This also lends support to the fronds being collected at the same time and place (i.e., Bowie Co., Texas). The two specimens (prior to removal to separate sheets) were annotated by Correll using an offset printed annotation label. Across the top was printed "ANNOTATION LABEL." Under this was inked in blue: "*Dryopteris cristata* (L.) Gray." Immediately below this was inked in "*Osmunda cinnamomea* L." Further below the *Osmunda* annotation was offset-printed "DETERMINED BY DONOVAN S. CORRELL," followed by a handwritten "1951" at the right margin. Upon separation of the fronds, the annotation label was removed from the original sheet and split lengthwise between the two binomials, as determined by the matching proportions of the raw cut edges. To the *Dryopteris* portion (upper half) of the label was written in: "det. Donovan S. Correll 1951," but not in the hand of Correll. This was affixed to a new herbarium sheet (MO 2139996) with the photocopied label and *Dryopteris* frond. Two additional annotations are now on the sheet, one by T.H. Peck 1985, the other by R. Cranfill 1981, both identifying the specimen as *D. celsa*. The *Osmunda cinnamomea* specimen was also removed from the original sheet and remounted on a new herbarium sheet, along with the original label. The elliptical Missouri Botanical Garden stamp with the accession number (MO 925450) was cut from the original sheet and glued to this new sheet. The original label and accession number were included with the *Osmunda* sheet, possibly because it made the identification correct and may have been presumed to be what Palmer intended to collect. In addition to this information on the herbarium sheet, the bottom portion of the cut annotation label identifying the specimen as *O. cinnamomea* was included. A small part of the lower left corner is missing from this annotation label but is otherwise visibly unaltered after being sectioned. Since the now-*Osmunda* sheet (MO 925450) is not annotated by anyone other than Correll, who saw the two fronds mounted on the same sheet, it is assumed that no one else has critically studied the specimen, possibly because there is no reason to assume there is more than one *Palmer 29404* specimen in the same herbarium. Mention must be made that the annotation of these two sheets was not done by Correll, but by an unknown person using Correll's original annotation label, but in a doubly altered form (cut and amended). It appears reasonable to assume that the original mixed specimens were mounted in the mid to late 1920s, shortly after its collection in 1925. It is likely that the specimens were split and remounted in the early 1970s (a time when photocopying was developed enough to achieve acceptable reproduction). According to John Pruski (pers. comm.) of the Missouri Botanical Garden, MO 2300000 was mounted in 1976, making the separation date above proximate. He also said MO splits mixed sheets when they are noticed, and then the policy is to write on each sheet what was formerly mixed with it. Unfortunately, such notation was not done in this case.

The GH sheet (Fig. 4) has sterile fronds of *Dryopteris celsa* (left) and *Osmunda cinnamomea* (right) on it. The *Osmunda* determination is confirmed by Correll as "! DSC" in his hand. No date is given. Near the *Dryopteris* frond is penciled "*Dryopteris cristata* (L.) A. Gray" followed below with "! DSC 1947." Comparison of handwriting shows that none of this appears to be in the hand of Correll. Generally, the exclamation mark before a name (or initials) means that the person considers the determination as correct, in this case, the *Osmunda* frond. Lack of an exclamation mark means a new or initial determination is made and the new name written in. Nonetheless, the identification of the *Dryopteris* frond is incorrect — the specimen is *D. celsa*, not *D. cristata*.

Correll (1956) mentioned the mixed nature of the GH sheet and the original unseparated MO sheet and used in his citation of *Dryopteris cristata* in Texas as "*Palmer 29404* (in part)." The mixed nature of the sheets was also explained in the discussion following the specimen citation (see above). This was also mentioned in Correll and Johnson (1970, 1972) and Correll and Correll (1972), as "*Palmer 29404*, p.p.," but in these circumstances no further explanation was afforded as in Correll (1956). Since Correll (1956) never examined the UMO sheet, he didn't know the full extent of the mixture. Nor could he have been aware of the later separation of the fronds on the MO sheet. Later workers should have been alerted to the alterations in the now two MO specimens through a literature review of the references mentioned in this paragraph, or, if examining both MO specimens, the

unusual appearance of the sheets. Other than for the current authors, there is no evidence that anyone else has examined both sheets.

The above mentioned misidentification by Correll, unequally mixed sheets, and later separation of specimens have combined to create a perplexing situation that could only be untangled by examination of all the specimens involved. Other than the misidentification, only Correll (1956) correctly assessed the problem. For other botanists, the outcomes depended upon which specimen(s) was/were studied. In summary, the UMO specimen is *Osmunda cinnamomea*, the GH specimen is mixed (*Dryopteris* celsa and *O. cinnamomea*), while the originally mixed MO sheet has been split into two specimens, one [MO 925450] is *O. cinnamomea* and the other [MO 2139996] is *D. celsa*. Finally, this does eliminate the confusion associated with the reports of *D. celsa* in Texas.

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Figure 1. *Osmunda cinnamomea* (*E.J. Palmer 29404*, UMO).

Figure 2 *Osmunda cinnamomea* (*E.J. Palmer 29404*, MO). Separated from *Dryopyeris celsa* on original MO sheet (see text).

Figure 3. *Dryopyeris celsa* (*E.J. Palmer 29404*, MO). Separated from *Osmunda cinnamomea* on original MO sheet (see text)

Figure 4 GH sheet of *E J Palmer 29404*, composed of *Dryopteris celsa* (left) and *Osmunda cinnamomea* (right)

Angelo, R. and D.E. Boufford. 2011. Atlas of the flora of New England: Salicaceae to Brassicaceae. Phytoneuron 2011-12: 1–16 + figs. 1–53 (maps).

ATLAS OF THE FLORA OF NEW ENGLAND: SALICACEAE TO BRASSICACEAE

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ABSTRACT

Dot maps are provided to depict the distribution at the county level of the taxa of Magnoliophyta: Salicaceae to Brassicaceae (corresponding to *Flora of North America*, *Volume 7* (Flora of North America Editorial Committee 2010)) growing outside of cultivation in the six New England states of the northeastern United States. The maps treat 205 taxa (species, subspecies, varieties, and hybrids, but not forms) based primarily on specimens in the major herbaria of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut, with most data derived from the holdings of the New England Botanical Club Herbarium (NEBC). Brief synonymy (to account for names used in standard manuals and floras for the area), habitat, chromosome information, and common names are also provided.

KEY WORDS. Flora, New England, atlas, distribution, Brassicaceae, Capparaceae, Cleomaceae, Limnanthaceae, Resedaceae, Salicaceae, Tropaeolaceae

This article is the eighth in a series (Angelo & Boufford 1996, 1998, 2000, 2007, 2010, 2011, 2012) that will present the distributions of the vascular flora of New England in the form of dot distribution maps at the county level (Fig. 1). The atlas is posted on the internet at http://neatlas.org, where it will be updated as new information becomes available.

This project encompasses all vascular plants (pteridophytes and spermatophytes) at the rank of species, subspecies, and variety growing independent of cultivation in the six New England states. Hybrids are also included, but forms and other ranks below the level of variety are not. The dots are based on voucher specimens primarily in New England herbaria (of colleges, universities, botanical gardens, and public museums) representing reproducing populations outside of cultivated habitats. This eighth installment includes the families in Magnoliophyta: Salicaceae to Brassicaceae corresponding to the families treated in *Flora of North America*, *Volume 7* (Flora of North America Editorial Committee 2010). Of the 205 taxa treated, 109 are not native to the region – a surprising 53%. Future accounts will treat the distribution of additional non-monocot angiosperms.

The habitat data are distillations from a variety of sources augmented by our own field observations. An attempt was made to indicate habitat information as it applies to a particular taxon in New England rather than to the entire range of the taxon. Such information is omitted where habitat is not indicated on the label and where we also lack personal knowledge of the plant in New England. All omissions of habitat information are for a few introduced taxa and for all hybrids.

We plan to gather this series of articles, together with additional background material, into a separate volume upon completion of all the installments. It is our hope, in the meantime, that these articles will stimulate additional field work to supplement the distributions portrayed in the maps.

The New England Botanical Club herbarium has proven to be the most important resource for this project. We are eager to receive information on voucher specimens in public herbaria documenting range extensions and filling county gaps in distributions. Similarly, because the atlas of the New England flora will be continuously updated as new information becomes available, we are eager to receive notification of published corrections of cytological information and new, documented chromosome counts for taxa in the New England flora.

MATERIALS AND METHODS

Materials and methods are as outlined in Angelo and Boufford (1996) and at http://neatlas.org/Intro-Pterid&Gym.html, and are not repeated here..

TAXONOMY AND FORMAT

The taxonomy and nomenclature adopted for this work essentially follow that of the Flora of North America project, except that families, genera, and species are arranged alphabetically. The families and their circumscription do not necessarily reflect current views on relationships or composition. The Angiosperm Phylogeny Website (Stevens 2001 onwards) should be consulted for a continuously updated treatment of families and their inclusive genera. Named and unnamed hybrid taxa are placed alphabetically at the end of the genus in which they occur. Unnamed hybrids combine the names of the progenitors alphabetically by epithet. Taxa that are not native to New England are indicated by uppercase text. Unpublished names are not used, even if publication is pending.

Chromosome numbers are taken primarily from *Flora of North America, Volume 7* (Flora of North America Editorial Committee 2010) and from Missouri Botanical Garden's Index to Plant Chromosome Numbers [website (http://mobot.mobot.org/W3T/Search/ipcn.html); St. Louis, MO].

Synonymy is provided primarily with respect to names accepted in standard manuals covering New England published from 1950 onward, including Fernald (1950), Gleason (1952), Gleason and Cronquist (1991), and Seymour (1982). Synonyms have not been provided where the distribution for the synonymized name does not include New England.

The following list (which includes excluded taxa) will aid readers in finding familiar names that have been transferred to other taxa:

Capparaceae	=>	Cleomaceae
Alyssum (in part)	=>	*Aurinia*
Arabis (in part)	=>	*Arabidopsis*
Arabis (in part)	=>	*Boechera*
Arabis (in part)	=>	*Turritis*
Armoracia (in part)	=>	*Rorippa*
Brassica (in part)	=>	*Sinapis*
Cardaria	=>	*Lepidium*
Cleome (in part)	=>	*Peritoma*
Cleome (in part)	=>	*Tarenaya*
Coronopus	=>	*Lepidium*
Dentaria	=>	*Cardamine*
Neobeckia	=>	*Rorippa*
Neotularia (in part)	=>	*Braya*
Rorippa (in part)	=>	*Nasturtium*

The following species have been reported from our area but are excluded for the reasons noted:

Arabis procurrens Waldstein & Kitaibel [no voucher for wild occurrence found; reported from Massachusetts]

Diplotaxis erucoides (Linnaeus) de Candolle [no voucher for wild occurrence found; reported from Massachusetts]

Draba aurea Vahl *ex* Hornemann [specimen collected from Barnstable Co., Massachusetts lacks information to indicate wild occurrence]

Draba lactea Adams (*D. allenii* Fernald) [no specimen located; reported from Maine]

Draba nivalis Liljeblad [specimen collected from Barnstable Co., Massachusetts lacks information to indicate wild occurrence]

Lepidium hirtum (Linnaeus) Smith [no specimen located; reported from Maine]

Lepidium ramosissimum A. Nelson [no specimen located; reported from Maine]

Malcolmia maritima (Linnaeus) W.T. Aiton [no specimen located; reported from New Hampshire]

Rorippa sessiliflora (Nuttall) Hitchcock [specimen from Massachusetts is deemed not to represent wild occurrence]

Salix aurita Linnaeus [no specimen located; reported from Massachusetts]

Salix daphnoides Villars [no specimen located; reported from Massachusetts]

ANGIOSPERMAE (MAGNOLIOPHYTA) - ANGIOSPERMS

BRASSICACEAE

ALLIARIA PETIOLATA (M. Bieberstein) Cavara & Grande—Garlic Mustard (Figure 2). $2n = 42$. Shaded roadsides, waste places, fields, thin woods. From Eurasia, northern Africa. [*A. OFFICINALIS* Andrzejowski *ex* M. Bieberstein]

ALYSSUM ALYSSOIDES (Linnaeus) Linnaeus—Pale Madwort (Figure 2). $2n = 32$. Dry fields, roadsides, waste places. From Eurasia, northern Africa.

Arabidopsis lyrata (Linnaeus) O'Kane & Al-Shehbaz subsp. *lyrata*—Sand Cress (Figure 2). $2n = 16$, 32. Dry ledges (especially basic soil), gravels, sands. [*Arabis lyrata* Linnaeus]

ARABIDOPSIS THALIANA (Linnaeus) Heynhold—Mouse-ear Cress (Figure 2). $2n = 10$. Sandy roadsides, waste places, dry fields. From Eurasia.

Arabis alpina Linnaeus—Alpine Rock-cress (Figure 3). $2n = 16$. Calcareous rocks, alpine meadows.

ARABIS CAUCASICA Willdenow—Garden Rock-cress (Figure 3). $2n = 16$. Waste places. From southwestern Asia.

Arabis pycnocarpa M. Hopkins var. *pycnocarpa*—Hairy Rock-cress (Figure 3). 2*n* = 32. Dry, calcareous ledges. [*A. hirsuta* (Linnaeus) Scopoli var. *pycnocarpa* (M. Hopkins) Rollins]

ARMORACIA RUSTICANA P. Gaertner, B. Meyer & Scherbius—Horseradish (Figure 3). 2*n* = 32. Moist soil of waste places, roadsides, fields. From Eurasia. [*A. LAPATHIFOLIA* Gilibert]

AURINIA SAXATALIS (Linnaeus) Desvaux—Basket-of-gold (Figure 4). 2*n* = 16. Rock outcrops. From Eurasia. [*ALYSSUM SAXATILE* Linnaeus]

Barbarea orthoceras Ledebour—American Yellow-rocket (Figure 4). 2*n* = 16. Streambanks, swamps, wet rocks.

BARBAREA STRICTA Andrzejowski—Small-flowered Winter-cress (Figure 4). 2*n* = 16. Roadsides, waste places, fields, usually in moist soil. From Eurasia. [*B. VULGARIS* W.T. Aiton (in part) misapplied]

BARBAREA VERNA (Miller) Ascherson—Early Winter-cress (Figure 4). 2*n* = 16. Roadsides, fields, waste places. From Eurasia.

BARBAREA VULGARIS W.T. Aiton—Common Winter-cress (Figure 5). 2*n* = 16. Roadsides, fields, waste places, usually in moist soil. From Eurasia, northern Africa. [*B. VULGARIS* var. *ARCUATA* (Opiz *ex* C. Presl) Fries; *B. VULGARIS* var. *BRACHYCARPA* Rouy & Foucaud]

BERTEROA INCANA (Linnaeus) de Candolle—Hoary Alyssum (Figure 5). 2*n* = 16. Dry fields, roadsides, waste places. From Eurasia.

BERTEROA MUTABILIS (Ventenat) de Candolle—(Figure 5). 2*n* = 74, 111, 148, 185. Roadsides, waste places. From Eurasia.

Boechera canadensis (Linnaeus) Al-Shehbaz—Sicklepod (Figure 5). 2*n* = 14. Rocky wooded slopes, rich woods. [*Arabis canadensis* Linnaeus]

Boechera grahamii (Lehmann) Windham & Al-Shehbaz—Purple Rock-cress (Figure 6). 2*n* = 21. Ledges. [*Arabis brachycarpa* (Torrey & A. Gray) Britton; *Arabis divaricarpa* A. Nelson misapplied]

Boechera laevigata (Muhlenberg *ex* Willdenow) Al-Shehbaz—Smooth Rock-cress (Figure 6). 2*n* = 14. Dry, rocky, wooded slopes, shaded ledges (chiefly calcareous), rich woods. [*Arabis laevigata* (Muhlenberg *ex* Willdenow) Poiret]

Boechera missouriensis (Greene) Al-Shehbaz—Green Rock-cress (Figure 6). 2*n* = ? Dry ledges, rocky woods. [*Arabis missouriensis* Greene]

Boechera stricta (Graham) Al-Shehbaz—Drummond's Rock-cress (Figure 6). 2*n* = 14. Rocky slopes, ledges. [*Arabis drummondii* A. Gray]

BRASSICA JUNCEA (Linnaeus) Czernajew—Indian Mustard (Figure 7). 2*n* = 36. Fields, waste places, roadsides. From Eurasia, Africa. [*B. JUNCEA* var. *CRISPIFOLIA* L.H. Bailey]

BRASSICA NAPUS Linnaeus—Turnip (Figure 7). 2*n* = 38. Fields, waste places, roadsides. From Eurasia, Africa. [*B. NAPOBRASSICA* (Linnaeus) Miller]

BRASSICA NIGRA (Linnaeus) W.D.J. Koch—Black Mustard (Figure 7). $2n = 16$. Fields, waste places, roadsides. From Eurasia, Africa.

BRASSICA OLERACEA Linnaeus—Cabbage (Figure 7). $2n = 18$. Waste places. From Eurasia, Africa.

BRASSICA RAPA Linnaeus—Field Mustard (Figure 8). $2n = 20$. Fields, waste places, roadsides. From Eurasia, Africa.

Braya humilis (C.A. Meyer) B.L. Robinson subsp. *humilis*—Northern Rock-cress (Figure 8). $2n = 28$, 42, 56, 70. Calcareous cliffs and talus. [*B. humilis* var. *leiocarpa* (Trautvetter) Fernald; *Neotorularia humilis* (C.A. Meyer) Hedge & J. Léonard]

BUNIAS ORIENTALIS Linnaeus—Turkish Rocket (Figure 8). $2n = 14$. Roadsides, waste places. From Eurasia.

Cakile edentula (Bigelow) Hooker var. *edentula*—American Sea-rocket (Figure 8). $2n = 18$. Sandy sea beaches..

CAMELINA MICROCARPA de Candolle—(Figure 9). $2n = 40$. Fields, roadsides, railroads. From Eurasia, northern Africa.

CAMELINA SATIVA (Linnaeus) Crantz—Gold-of-pleasure (Figure 9). $2n = 40$. Fields, roadsides, waste places. From Eurasia.

CAPSELLA BURSA-PASTORIS (Linnaeus) Medikus—Shepherd's-purse (Figure 9). $2n = 32$. Roadsides, fields, waste places. From Eurasia, northern Africa. [*C. BURSA-PASTORIS* var. *BIFIDA* Crépin; *C. RUBELLA* Reuter]

Cardamine bellidifolia Linnaeus—Alpine Cress (Figure 9). $2n = 16$. Alpine brooks, wet, mossy rocks at high altitudes.

Cardamine bulbosa (Schreber *ex* Muhlenberg) Britton, Sterns & Poggenburg—Spring Cress (Figure 10). $2n = 16$, 56, 64, 80, 96, 112. About springs, wet woods, meadows. [*C. rhomboidea* (Persoon) de Candolle]

Cardamine concatenata (Michaux) O. Schwarz—Pepper-root (Figure 10). $2n = 128$-256. Rich, moist woods, calcareous rocky banks. [*Dentaria laciniata* Muhlenberg *ex* Willdenow]

Cardamine dentata Schultes—(Figure 10). $2n = 64$, ca. 80. Margins of shallow water, often calcareous, swampy woods. [*C. pratensis* Linnaeus var. *palustris* Wimmer & Grabowski; see Marhold 1994, also Marhold (pers. comm.)]

Cardamine diphylla (Michaux) Alph. Wood—Crinkleroot (Figure 10). $2n = 96$. Rich, moist woods. [*Dentaria diphylla* Michaux]

Cardamine douglassii Britton—Purple Cress (Figure 11). $2n = 56$, 64, 96, 112 144. Rich, moist woods.

CARDAMINE FLEXUOSA Withering—Woodland Bitter-cress (Figure 11). $2n = 32$. Fields, roadsides, disturbed areas. From Eurasia.

CARDAMINE HIRSUTA Linnaeus—Hairy Bitter-cress (Figure 11). $2n = 16$. Roadsides, fields, waste places. From Eurasia.

CARDAMINE IMPATIENS Linnaeus—Narrow-leaved Bitter-cress (Figure 11). $2n = 16$. Shaded grasslands, roadsides, disturbed areas, open woodlands. From Eurasia.

Cardamine longii Fernald—(Figure 12). $2n = ?$ Tidal estuaries, tidal marshes.

Cardamine maxima (Nuttall) Alph. Wood—Large Toothwort (Figure 12). $2n = 120, 124, 132, 138, 156, 161$, ca. 208. Rich woods, woodland streambanks. [*C. anomala* (Eames) K. Schumann; *Dentaria anomala* Eames; *D. maxima* Nuttall]

Cardamine parviflora Linnaeus—Sand Bitter-cress (Figure 12). $2n = 16$. Dry, rocky or sandy woods, ledges. [*C. parviflora* var. *arenicola* (Britton) O.E. Schulz]

Cardamine pensylvanica Muhlenberg *ex* Willdenow—Common Bitter-cress (Figure 12). $2n = 32, 64$. Springs, brooksides, pond shores, swamps. [*C. pensylvanica* var. *brittoniana* Farwell]

Cardamine pratensis Linnaeus—Cuckooflower (Figure 13). $2n = 16$. Meadows, moist grounds.

—***Cardamine* hybrids**—

Cardamine concatenata (Michaux) O. Schwarz × *C. maxima* (Nuttall) Alph. Wood—(Figure 13). [*C.* × *incisa* K. Schumann; *Dentaria* × *incisifolia* Eames *ex* Britton]

CHORISPORA TENELLA (Pallas) de Candolle—Purple Mustard (Figure 13). $2n = 14$. Roadsides, fields, waste places. From Eurasia, northern Africa.

CONRINGIA ORIENTALIS (Linnaeus) Dumortier—Hare's-ear Mustard (Figure 13). $2n = 14$. Roadsides, fields, waste places. From Eurasia.

Descurainia incana (Bernhardi *ex* Fischer & C.A. Meyer) Dorn—Mountain Tansy-mustard (Figure 14). $2n = 14, 28$. Calcareous gravels, roadsides. [*D. richardsonii* O.E. Schulz]

Descurainia pinnata (Walter) Britton subsp. *brachycarpa* (Richardson) Detling—Green Tansy-mustard (Figure 14). $2n = 14, 28$. Roadsides, dry, rocky or sandy soils.

DESCURAINIA SOPHIA (Linnaeus) Webb *ex* Prantl—Flixweed (Figure 14). $2n = 28$. Roadsides, waste places. From Eurasia.

DIPLOTAXIS MURALIS (Linnaeus) de Candolle—Annual Wall-rocket (Figure 14). $2n = 42$. Waste places, roadsides. From Eurasia, Africa.

DIPLOTAXIS TENUIFOLIA (Linnaeus) de Candolle—Perennial Wall-rocket (Figure 15). $2n = 22$. Waste places, roadsides. From Eurasia, Africa.

Draba arabisans Michaux—Rock Whitlow-grass (Figure 15). $2n = 96$. Rock outcrops, usually calcareous or dolomitic.

Draba cana Rydberg—Ashy Whitlow-grass (Figure 15). $2n = 32$. Calcareous cliffs. [*D. brewerí* S. Watson var. *cana* (Rydberg) Rollins; *D. lanceolata* Royle - misapplied]

Draba glabella Pursh—Smooth Whitlow-grass (Figure 15). $2n = 64, 80$. Rock outcrops, usually calcareous. [*D. glabella* var. *orthocarpa* (Fernald & Knowlton) Fernald]

Draba incana Linnaeus—Twisted Whitlow-grass (Figure 16). $2n = 32$. Rock outcrops, usually calcareous.

Draba reptans (Lamarck) Fernald—Carolina Whitlow-grass (Figure 16). $2n = 16, 30, 32$. Fields, ledges, dry sands.

DRABA VERNA Linnaeus—Common Whitlow-grass (Figure 16). $2n = 14, 16, 20, 24, 28, 30, 32, 34, 36, 38, 40, 52, 54, 58, 60, 64$. Roadsides, fields, waste places, open, dry places. From Eurasia, northwestern Africa. [*D. VERNA* var. *BOERHAAVII* (H.C. Hall) Dumortier]

ERUCA VESICARIA (Linnaeus) Cavanilles subsp. *SATIVA* (Miller) Thellung—Arugula (Figure 16). $2n = 22$. Waste places, roadsides, fields. From Europe, Africa. [*ERUCA SATIVA* Miller]

ERUCASTRUM GALLICUM (Willdenow) O.E. Shulz—Dog Mustard (Figure 17). $2n = 30$. Waste places, roadsides, railroads, fields. From Europe.

ERYSIMUM CHEIRANTHOIDES Linnaeus—Wormseed Mustard (Figure 17). $2n = 16$. Waste places, roadsides, railroads, fields. From Eurasia, northern Africa.

ERYSIMUM HIERACIFOLIUM Linnaeus—European Wallflower (Figure 17). $2n = 81$. Roadsides, waste places, fields. From Eurasia.

ERYSIMUM INCONSPICUUM (S. Watson) MacMillan—Small-flowered Prairie-rocket (Figure 17). $2n = 26$. Railroad embankments, roadsides, dry, open soil. From farther west.

ERYSIMUM MARSCHALLIANUM Andrzejowski *ex* M. Bieberstein—(Figure 18). $2n = 48$. Moist thickets. [*E. DURUM* J. Presl & C. Presl; Note: Dr. Ihsan Al-Shehbaz (pers. comm.) believes the Grand Isle Co., VT voucher to be *E. VIRGATUM* Roth]

ERYSIMUM ODORATUM Ehrhart—Pannonian Wallflower (Figure 18). $2n = 14, 32$. Wool waste. From Eurasia.

ERYSIMUM REPANDUM Linnaeus—Spreading Wallflower (Figure 18). $2n = 16$. Waste places, roadsides. From Eurasia, northern Africa.

EUCLIDIUM SYRIACUM (Linnaeus) W.T. Aiton—(Figure 18). $2n = 14$. Waste places, roadsides. From Eurasia.

HESPERIS MATRONALIS Linnaeus—Dame's-rocket (Figure 19). $2n = 24$. Roadsides, waste places, thickets. From Eurasia, northern Africa.

IBERIS AMARA Linnaeus—Rocket Candytuft (Figure 19). $2n = 14$. Waste places, especially dumps. From western Europe.

IBERIS SEMPERVIRENS Linnaeus—Evergreen Candytuft (Figure 19). $2n = 22$. Fields, waste places. From Europe.

IBERIS UMBELLATA Linnaeus—Globe Candytuft (Figure 19). $2n = 14, 16, 18, 34$. Waste places. From Europe.

ISATIS TINCTORIA Linnaeus—Dyer's Woad (Figure 20). $2n = 14, 28$. Roadsides, fields, waste places. From Eurasia, northern Africa.

LEPIDIUM CAMPESTRE (Linnaeus) W.T. Aiton—Cow-cress (Figure 20). 2*n* = 16. Waste places, fields, roadsides. From Eurasia.

LEPIDIUM CORONOPUS (Linnaeus) Al-Shehbaz—Swine-cress (Figure 20). 2*n* = 32. Waste places, fields, roadsides. From Eurasia, northern Africa. [*CORONOPUS SQUAMATUS* (Forsskål) Ascherson]

LEPIDIUM DENSIFLORUM Schrader—Prairie Peppergrass (Figure 20). 2*n* = 32. Roadsides, waste places, railroads. From farther west or south.

LEPIDIUM DIDYMUM Linnaeus—Lesser Wort-cress (Figure 21). 2*n* = 32. Waste places, roadsides, fields. Form South America. [*CORONOPUS DIDYMUM* (Linnaeus) Smith]

LEPIDIUM DRABA Linnaeus—Hoary Cress (Figure 21). 2*n* = 32, 64. Roadsides, waste places, fields. From Eurasia. [*CARDARIA DRABA* (Linnaeus) Desvaux]

LEPIDIUM HETEROPHYLLUM Bentham—Smith's Pepperwort (Figure 21). 2*n* = 48. Roadsides, fields, waste places.

LEPIDIUM LATIFOLIUM Linnaeus—Dittander (Figure 21). 2*n* = 24. Waste places, tidal shores. From Eurasia, northern Africa.

LEPIDIUM PERFOLIATUM Linnaeus—Clasping Pepperwort (Figure 22). 2*n* = 16. Roadsides, railroads, fields, waste places. From Eurasia, northern Africa.

LEPIDIUM RUDERALE Linnaeus—Roadside Pepperwort (Figure 22). 2*n* = 16, 32. Roadsides, waste places, railroads. From Eurasia.

LEPIDIUM SATIVUM Linnaeus—Garden Cress (Figure 22). 2*n* = 16, 32. Roadsides, waste places. From Eurasia.

Lepidium virginicum Linnaeus subsp. *virginicum*—Wild Pepper-grass (Figure 22). 2*n* = 32. Roadsides, waste places, dry, open soil.

LOBULARIA MARITIMA (Linnaeus) Desvaux—Sweet Alyssum (Figure 23). 2*n* = 24. Waste places, roadsides. From Eurasia, Africa.

LUNARIA ANNUA Linnaeus—Honesty (Figure 23). 2*n* = 30. Roadsides, waste places. From Europe.

MICROTHLASPI PERFOLIATUM (Linnaeus) F.K. MEYER—Perfoliate Penny-cress (Figure 23). 2*n* = 14, 28, 42. Fields, waste places. From Eurasia, northern Africa. [*THLASPI PERFOLIATUM* Linnaeus]

NASTURTIUM MICROPHYLLUM Boenninghausen *ex* Reichenbach—(Figure 23). 2*n* = 64. Brooks. From Europe. [*N. OFFICINALE* W.T. Aiton var. *MICROPHYLLUM* (Boenninghausen *ex* Reichenbach) Thellung; *RORIPPA MICROPHYLLA* (Boenninghausen *ex* Reichenbach) Hylander *ex* Á. Löve & D. Löve]

NASTURTIUM OFFICINALE W.T. Aiton—True Water-cress (Figure 24). 2*n* = 32. Brooks, ditches, springheads. From Eurasia, northern Africa. [*N. OFFICINALE* var. *SIIFOLIUM* Reiche; *RORIPPA NASTURTIUM-AQUATICUM* (Linnaeus) Hayek]

—***Nasturtium* hybrids—**

NASTURTIUM × *STERILE* (Airy Shaw) Oefelein—(Figure 24). [*N. MICROPHYLLUM* Boenninghausen *ex* Reichenbach × *N. OFFICINALE* W.T. Aiton; *RORIPPA* × *STERILIS* Airy Shaw]

NESLIA PANICULATA (Linnaeus) Desvaux—Ball-mustard (Figure 24). 2*n* = 14. Railroads, waste places, fields, roadsides. From Eurasia, northern Africa.

RAPHANUS RAPHANISTRUM Linnaeus—Wild Radish (Figure 24). 2*n* = 18. Fields, waste places, roadsides, railroads. From Eurasia.

RAPHANUS SATIVUS Linnaeus—Garden Radish (Figure 25). 2*n* = 18. Fields, roadsides, waste places. From Eurasia.

RAPISTRUM RUGOSUM (Linnaeus) Allioni—Bastard Cabbage (Figure 25). 2*n* = 16. Waste places, roadsides. From Europe. [*R. RUGOSUM* var. *VENOSUM* (Persoon) de Candolle]

RORIPPA AMPHIBIA (Linnaeus) Besser—Great Yellow-cress (Figure 25). 2*n* = 16, 32. Quiet water, shores, waste places. From Eurasia.

Rorippa aquatica (Eaton) E.J. Palmer & Steyermark—Lake-cress (Figure 25). 2*n* = 24. Lakes, quiet streams. [*Armoracia aquatica* (Eaton) Wiegand; *A. lacustris* (A. Gray) Al-Shehbaz & V.M. Bates; *Neobeckia aquatica* (Eaton) Greene]

RORIPPA AUSTRIACA (Cranz) Besser—Austrian Yellow-cress (Figure 26). 2*n* = 24. Low fields, muddy shores, ditches. From Europe.

RORIPPA GLOBOSA (Turczaninow *ex* Fischer & C.A. Meyer) Hayek—Wind Cauliflower (Figure 26). 2*n* = 16. Waste places. From eastern Asia.

Rorippa palustris (Linnaeus) Besser subsp. *palustris*—Marsh Cress (Figure 26). 2*n* = 32. Shores, damp openings, ditches. [*R. palustris* subsp. *fernaldiana* (Butters & Abbe) Jonsell; *R. islandica* (Oeder *ex* Murray) Borbás var. *fernaldiana* Butters & Abbe; *R. islandica* var. *islandica* misapplied]

Rorippa palustris (Linnaeus) Besser subsp. *hispida* (Desvaux) Jonsell—(Figure 26). 2*n* = 32. Shores, damp openings, waste places. [*R. islandica* (Oeder *ex* Murray) Borbás var. *hispida* (Desvaux) Butters & Abbe; *R. islandica* var. *islandica* misapplied]

RORIPPA SYLVESTRIS (Linnaeus) Besser—Creeping Yellow-cress (Figure 27). 2*n* = 32, 40, 48. Wet roadsides, meadows, other wet places. From Eurasia.

—***Rorippa* hybrids—**

RORIPPA × *PROSTRATA* (J.P. Bergeret) Schinz & Thellung—(Figure 27). [*R. AMPHIBIA* (Linnaeus) Besser × *R. SYLVESTRIS* (Linnaeus) Besser]

SINAPIS ALBA Linnaeus—White Mustard (Figure 27). 2*n* = 24. Roadsides, waste places, railroads. From Eurasia. [*BRASSICA ALBA* (Linnaeus) Rabenhorst; *B. HIRTA* Moench]

SINAPIS ARVENSIS Linnaeus—Charlock (Figure 27). 2*n* = 18. Waste places, fields, roadsides. From Eurasia. [*BRASSICA KABER* (de Candolle) L.C. Wheeler; *B. KABER* var. *PINNATIFIDA* (Stokes) L.C. Wheeler; *B. KABER* var. *SCHKUHRIANA* (Reichenbach) L.C. Wheeler]

SISYMBRIUM ALTISSIMUM Linnaeus—Tumble-mustard (Figure 28). 2*n* = 14. Waste places, fields, roadsides. From Eurasia, northwestern Africa.

SISYMBRIUM IRIO Linnaeus—London Rocket (Figure 28). 2*n* = 14. Roadsides, railroads, waste places. From Eurasia, northern Africa.

SISYMBRIUM LOESELII Linnaeus—False London Rocket (Figure 28). 2*n* = 14. Waste places, fields, roadsides. From Eurasia.

SISYMBRIUM OFFICINALE (Linnaeus) Scopoli—Hedge-mustard (Figure 28). 2*n* = 14. Waste places, roadsides, fields. From Eurasia, northern Africa. [*S. OFFICINALE* var. *LEIOCARPUM* de Candolle]

SISYMBRIUM ORIENTALE Linnaeus—Indian Hedge-mustard (Figure 29). 2*n* = 14. Waste places, roadsides. From Eurasia, northern Africa.

Subularia aquatica Linnaeus subsp. *americana* G.A. Mulligan & Calder—Awlwort (Figure 29). 2*n* = 30. Submersed at sandy lake shores.

TEESDALIA NUDICAULIS (Linnaeus) W.T. Aiton—Shepherd's Cress (Figure 29). 2*n* = 36. Sandy fields, roadsides, waste places. From Eurasia.

THLASPI ARVENSE Linnaeus—Field Penny-cress (Figure 29). 2*n* = 14. Roadsides, waste places, fields. From Eurasia.

TROPIDOCARPUM GRACILE Hooker—Dobie Pod (Figure 30). 2*n* = 16. Wool waste. From farther west.

Turritis glabra Linnaeus—Tower-mustard (Figure 30). 2*n* = 12, 16, 32. Rich, open woods, ledges, fields, railroads. [*Arabis glabra* (Linnaeus) Bernhardi]

CLEOMACEAE

PERITOMA SERRULATA (Pursh) de Candolle—Rocky Mountain Beeplant (Figure 30). 2*n* = 34, 60. Waste places. From farther west. [*CLEOME SERRULATA* Pursh]

Polanisia dodecandra (Linnaeus) de Candolle subsp. *dodecandra*—Clammyweed (Figure 30). 2*n* = 20. Sandy or gravelly shores. [*P. graveolens* Rafinesque]

POLANISIA DODECANDRA (Linnaeus) de Candolle subsp. *TRACHYSPERMA* (Torrey & A. Gray) H.H. Iltis—Sandyseed (Figure 31). Roadsides. From farther west and south. [*P.TRACHYSPERMA* Torrey & A. Gray]

TARENAYA HASSLERIANA (Chodat) H.H. Iltis—Pink-queen (Figure 31). Waste places, roadsides. From South America. [*CLEOME HASSLERIANA* Chodat; *C. SPINOSA* (Jacquin) Rafinesque - misapplied]

LIMNANTHACEAE

Floerkea proserpinacoides Willdenow—False Mermaid (Figure 31). 2*n* = 10. Alluvial woods, usually wet.

RESEDACEAE

RESEDA ALBA Linnaeus—White Mignonette (Figure 31). $2n = 40$. Waste places, roadsides. From Eurasia, northern Africa.

RESEDA LUTEA Linnaeus—Yellow Mignonette (Figure 32). $2n = 48$. Fields, roadsides, waste places. From Eurasia, northern Africa.

RESEDA LUTEOLA Linnaeus—Dyer's Rocket (Figure 32). $2n = 24, 26$. Waste places. From Eurasia, northern Africa.

RESEDA ODORATA Linnaeus—Garden Mignonette (Figure 32). $2n = 12$. Waste places. From northern Africa.

SALICACEAE

POPULUS ALBA Linnaeus—White Poplar (Figure 32). $2n = 38$. Roadsides, waste places, field borders. From Eurasia.

Populus balsamifera Linnaeus—Balsam Poplar (Figure 33). $2n = 38$. Alluvial soils, streambanks, rich, low woods. [*P. balsamifera* var. *subcordata* Hylander]

Populus deltoides W. Bartram *ex* Marshall subsp. *deltoides*—Cottonwood (Figure 33). $2n = 38$. Streambanks, lake shores, floodplains.

Populus grandidentata Michaux—Bigtooth Aspen (Figure 33). $2n = 38$. Dry woods, recent burns, hillsides.

Populus heterophylla Linnaeus—Swamp Poplar (Figure 33). $2n = ?$ Swamps, flooded bottomlands.

POPULUS NIGRA Linnaeus—Lombardy Poplar (Figure 34). $2n = 38, 57$. Roadsides, old house sites. From Eurasia. [*P. NIGRA* var. *ITALICA* Münchhausen]

POPULUS TREMULA Linnaeus—European Aspen (Figure 34). $2n = 38$. Waste places. From Eurasia.

Populus tremuloides Michaux—Quaking Aspen (Figure 34). $2n = 38, 57, 76$. Dry, open woods, recent burns and clearings, roadsides. [*P. tremuloides* var. *magnifica* Victorin]

—***Populus* hybrids**—

Populus × *canadensis* Moench—(Figure 34). [*P. deltoides* W. Bartram *ex* Marshall subsp. *deltoides* × *P. NIGRA* Linnaeus]

POPULUS × *CANESCENS* (Aiton) Smith—Gray Poplar (Figure 35). [*P. ALBA* Linnaeus × *P. TREMULA* Linnaeus]

Populus × *heimburgii* B. Boivin—(Figure 35). [*P. ALBA* Linnaeus × *P. tremuloides* Michaux]

Populus × *jackii* Sargent—Balm-of-Gilead (Figure 35). [*P. balsamifera* Linnaeus × *P. deltoides* W. Bartram *ex* Marshall subsp. *deltoides*; *P.* × *gileadensis* Rouleau]

Populus × *rouleauiana* B. Boivin—(Figure 35). [*P. ALBA* Linnaeus × *P. grandidentata* Michaux]

Populus × *smithii* B. Boivin—(Figure 36). [*P. grandidentata* Michaux × *P. tremuloides* Michaux]

SALIX ALBA Linnaeus—White Willow (Figure 36). 2*n* = 76. Low moist ground, along streams, shores, roadsides. From Eurasia. [*S. ALBA* var. *CALVA* Michaux; *S. ALBA* var. *CALVA* (Linnaeus) Stokes]

Salix amygdaloides Andersson—Peach-leaved Willow (Figure 36). 2*n* = 38. Lake shores, low woods.

Salix arctophila Cockerell *ex* A. Heller—Northern Willow (Figure 36). 2*n* = 76. Alpine meadows.

Salix argyrocarpa Andersson—Labrador Willow (Figure 37). 2*n* = 76. Alpine or subalpine meadows.

SALIX ATROCINEREA Brotero—Rusty Willow (Figure 37). 2*n* = 76. Marshes, wooded wetlands. From Europe.

SALIX BABYLONICA Linnaeus—Weeping Willow (Figure 37). 2*n* = 76. Streambanks, shores, low grounds, near settlements. From Asia.

Salix bebbiana Sargent—Bebb Willow (Figure 37). 2*n* = 38. Damp thickets, springy places.

Salix candida Flüggé *ex* Willdenow—Hoary Willow (Figure 38). 2*n* = 38. Calcareous bogs and swamps.

SALIX CAPREA Linnaeus—Goat Willow (Figure 38). 2*n* = 38. Thickets, roadsides. From Europe.

SALIX CINEREA Linnaeus—Gray Willow (Figure 38). 2*n* = 76. Sandy or gravelly, freshwater shores, wet thickets, moist waste places. From Eurasia.

Salix cordata Michaux—Dune Willow (Figure 38). 2*n* = 38. Sandy or gravelly shores, beaches, dunes.

Salix discolor Muhlenberg—Pussy Willow (Figure 39). 2*n* = 76, 95, 114. Damp thickets, freshwater shores, swamps. [*S. discolor* var. *overi* C.R. Ball]

SALIX ELAEAGNOS Scopoli—Olive Willow (Figure 39). 2*n* = 38. Shores, rocky banks. From Europe. [*S. INCANA* Schrank]

Salix eriocephala Michaux—Wand Willow (Figure 39). 2*n* = 38. Low thickets, pond shores, streambanks, swamps. [*S. cordata* Muhlenberg var. *abrasa* Fernald; *S. rigida* Muhlenberg; *S. rigida* var. *angustata* (Pursh) Fernald]

Salix herbacea Linnaeus—Dwarf Willow (Figure 39). 2*n* = 38. Mossy rocks in alpine areas.

Salix humilis Marshall var. *humilis*—Prairie Willow (Figure 40). 2*n* = 38, 76. Dry thickets, openings, dry, mixed woods. [*S. humilis* var. *hyporhysa* Fernald; *S. humilis* var. *keweenawensis* Farwell]

Salix humilis Marshall var. *tristis* (Aiton) Griggs—Dwarf Prairie Willow (Figure 40). 2*n* = ? Dry barrens, open woods, swampy areas in woods. [*S. humilis* var. *microphylla* (Andersson) Fernald; *S. occidentalis* Walter]

Salix interior Rowlee—Sandbar Willow (Figure 40). 2*n* = 38. Sandy or silty alluvial soil, river sandbars, streambanks, shores. [*S. interior* var. *exterior* Fernald; *S. exigua* Nuttall subsp. *interior* (Rowlee) Cronquist]

Salix lucida Muhlenberg—Shining Willow (Figure 40). 2*n* = 76. Low grounds, freshwater shores, swamps. [*S. lucida* var. *angustifolia* (Andersson) Andersson; *S. lucida* var. *intonsa* Fernald]

Salix myricoides Muhlenberg—Blue-leaf Willow (Figure 41). 2*n* = ? River thickets, gravelly shores, usually in calcareous soil. [*S. glaucophylloides* Fernald]

SALIX MYRSINIFOLIA Salisbury—Dark-leaved Willow (Figure 41). 2*n* = 114. Waste places, roadsides. From Eurasia.

Salix nigra Marshall—Black Willow (Figure 41). 2*n* = 38. Streambanks, shores, rich, low, woods.

Salix pedicellaris Pursh—Bog Willow (Figure 41). 2*n* = 38, 57, 76. *Sphagnum* bogs and swamps, sphagnous shores. [*S. pedicellaris* var. *hypoglauca* Fernald; *S. pedicellaris* var. *tenuescens* Fernald]

Salix pellita (Andersson) Bebb—Satin Willow (Figure 42). 2*n* = 38. Streambanks, shores, rich, thickets.

SALIX PENTANDRA Linnaeus—Bay-leaved Willow (Figure 42). 2*n* = 38. Roadsides, meadows, shores, waste places. From Eurasia.

Salix petiolaris Smith—Slender Willow (Figure 42). 2*n* = 38. Meadows, river thickets, low, moist openings in deciduous woods. [*S. gracilis* Andersson; *S. gracilis* var. *textoris* Fernald; *S.* × *subsericea* (Andersson) C.K. Schneider]

Salix planifolia Pursh—Tea-leaved Willow (Figure 42). 2*n* = 57, 76. Alpine, subalpine and boreal meadows, streambanks, wet thickets.

SALIX PURPUREA Linnaeus—Purple Osier (Figure 43). 2*n* = 38. Low, wet ground. From Europe.

Salix pyrifolia Andersson—Balsam Willow (Figure 43). 2*n* = 38. Bogs, swamps, damp thickets.

Salix sericea Marshall—Silky Willow (Figure 43). 2*n* = ? River thickets, swamps. [*S. coactilis* Fernald]

Salix serissima (L.H. Bailey) Fernald—Autumn Willow (Figure 43). 2*n* = 76. Calcareous marshes, bogs and swamps.

SALIX TRIANDRA Linnaeus—Almond Willow (Figure 44). 2*n* = 38 (44), 57, 88. Streambanks, waste places. From Eurasia.

Salix uva-ursi Pursh—Bearberry Willow (Figure 44). 2*n* = 38. Exposed, rocky, alpine areas.

SALIX VIMINALIS Linnaeus—Osier (Figure 44). 2*n* = 38. Streambanks, roadsides, freshwater shores. From Europe.

—***Salix* hybrids**—

SALIX ALBA Linnaeus × *S. petiolaris* Smith—(Figure 44).

Salix bebbiana Sargent × *S. eriocephala* Michaux—(Figure 45).

Salix bebbiana Sargent × *S. humilis* Marshall var. *humilis*—(Figure 45).

Salix bebbiana Sargent × *S. petiolaris* Smith—(Figure 45).

Salix × *besscheli* B. Boivin—(Figure 45). [*S. bebbiana* Sargent × *S. discolor* Muhlenberg]

Salix candida Flüggé *ex* Willdenow × *S. pellita* (Andersson) Bebb—(Figure 46).

SALIX CINEREA Linnaeus × *S. eriocephala* Michaux—(Figure 46).

Salix cordata Michaux × *S. sericea* Marshall—(Figure 46).

Salix × *cryptodonta* Fernald—(Figure 46). [*S. bebbiana* Sargent × *S. candida* Flüggé *ex* Willdenow]

Salix discolor Muhlenberg × *S. eriocephala* Michaux—(Figure 47).

Salix discolor Muhlenberg × *S. humilis* Marshall var. *humilis*—(Figure 47).

Salix discolor Muhlenberg × *S. petiolaris* Smith—(Figure 47).

Salix discolor Muhlenberg × *S. pyrifolia* Andersson—(Figure 47).

SALIX × *EHRHARTIANA* G. Meyer—(Figure 48). [*S. ALBA* Linnaeus × *S. PENTANDRA* Linnaeus]

Salix eriocephala Michaux × *S. lucida* Muhlenberg—(Figure 48).

Salix eriocephala Michaux × *S. myricoides* Muhlenberg—(Figure 48).

Salix eriocephala Michaux × *S. pedicellaris* Pursh—(Figure 48).

Salix eriocephala Michaux × *S. petiolaris* Smith—(Figure 49).

Salix eriocephala Michaux × *S. sericea* Marshall—(Figure 49).

SALIX × *FRAGILIS* Linnaeus—Crack Willow (Figure 49). [*S. ALBA* Linnaeus × *S. EUXINA* I.V. Belyaeva; *S.* × *RUBENS* Schrank]

Salix × *grayi* C.K. Schneider—(Figure 49). [*S. argyrocarpa* Andersson × *S. planifolia* Pursh]

Salix humilis Marshall var. *humilis* × *S. petiolaris* Smith—(Figure 50).

Salix humilis Marshall var. *humilis* × *S. sericea* Marshall—(Figure 50).

Salix humilis Marshall var. *tristis* (Aiton) Griggs × *S. petiolaris* Smith—(Figure 50).

Salix × *jesupii* Fernald—(Figure 50). [*S. ALBA* Linnaeus × *S. lucida* Muhlenberg]

Salix lucida Muhlenberg × *S. serissima* (L.H. Bailey) Fernald —(Figure 51).

Salix × *peasei* Fernald—(Figure 51). [*S. herbacea* Linnaeus × *S. uva-ursi* Pursh]

SALIX × *PENDULINA* Wenderoth—Weeping Willow (Figure 51). [*S. BABYLONICA* Linnaeus × *S. EUXINA* I.V. Belyaeva]

Salix petiolaris Smith × *S. sericea* Marshall—(Figure 51).

Salix × *rubella* Bebb *ex* C.K. Schneider—(Figure 52). [*S. candida* Flüggé *ex* Willdenow × *S. eriocephala* Michaux]

SALIX × *SEPULCRALIS* Simonkai—Weeping Willow (Figure 52). [*S. ALBA* Linnaeus × *S. BABYLONICA* Linnaeus]

SALIX × *SMITHIANA* Willdenow—(Figure 52). [*S. CAPREA* Linnaeus × *S. VIMINALIS* Linnaeus; *S.* × *SERICANS* Tausch]

TROPAEOLACEAE

TROPAEOLUM MAJUS Linnaeus—Garden Nasturtium (Figure 52). $2n$ = 28. Waste places, roadsides. From South America.

TROPAEOLUM MINUS Linnaeus—Dwarf Nasturtium (Figure 53). $2n$ = ? Roadsides near dwellings. From South America.

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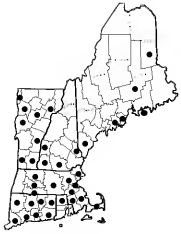
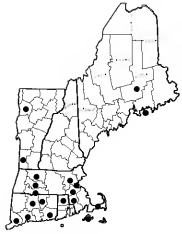
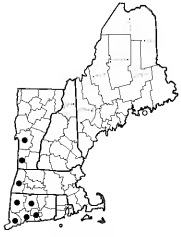
Figure 1 Key map for counties of the New England states (and Mt. Desert Island, Maine, Block Island, Rhode Island, arbitrary divisions of larger Maine counties and of Coös County, New Hampshire)



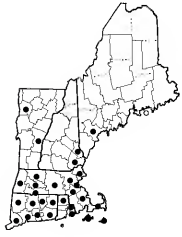
ALLIARIA PETIOLATA



ALYSSUM ALYSSOIDES

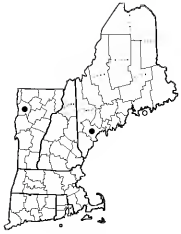


Arabidopsis lyrata
subsp. *lyrata*



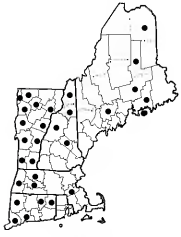
ARABIDOPSIS THALIANA

Figure 2. Distribution maps.

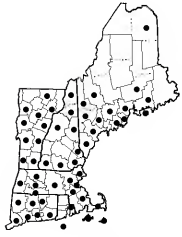


Arabis alpina

ARABIS CAUCASICA

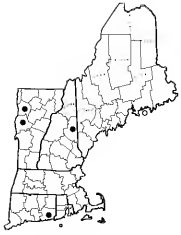


Arabis pycnocarpa
var. *pycnocarpa*



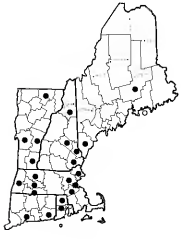
ARMORACIA RUSTICANA

Figure 3. Distribution maps.

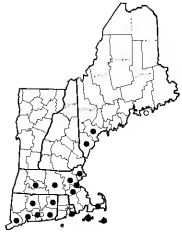


AURINIA SAXATALIS

Barbarea orthoceras

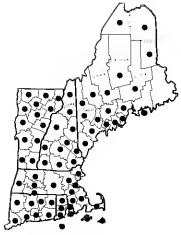


BARBAREA STRICTA

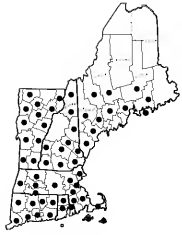


BARBAREA VERNA

Figure 4. Distribution maps.

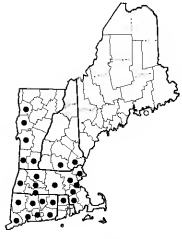


BARBAREA VULGARIS



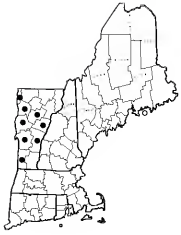
BERTEROA INCANA

BERTEROA MUTABILIS

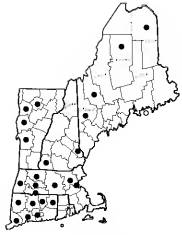


Boechera canadensis

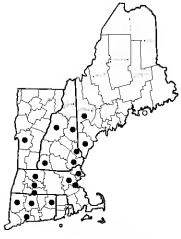
Figure 5. Distribution maps.



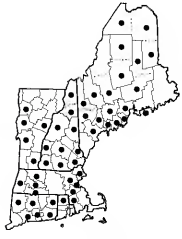
Boechera grahamii



Boechera laevigata

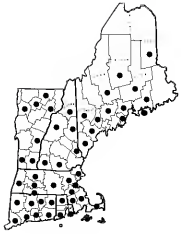


Boechera missouriensis

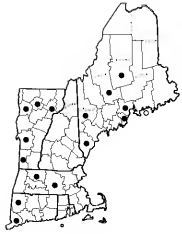


Boechera stricta

Figure 6. Distribution maps.



BRASSICA JUNCEA



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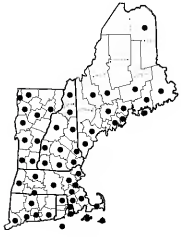

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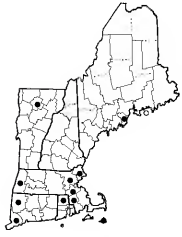
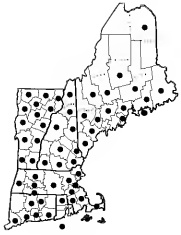


BRASSICA OLERACEA

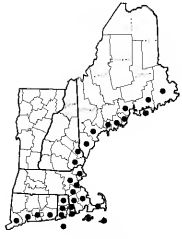
Figure 7. Distribution maps.



BRASSICA RAPA

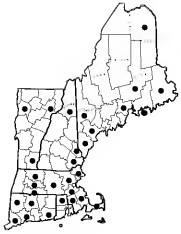
Braya humilis
subsp. *humilis*

BUNIAS ORIENTALIS

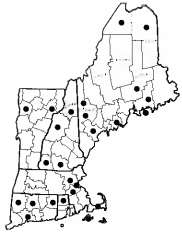


Cakile edentula
var. *edentula*

Figure 8. Distribution maps.



CAMELINA MICROCARPA



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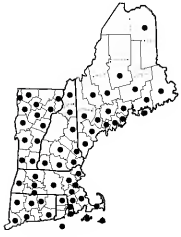
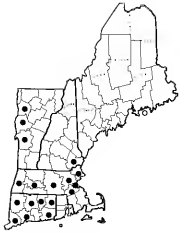


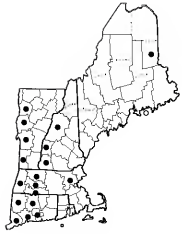
CAPSELLA BURSA-PASTORIS

Cardamine bellidifolia

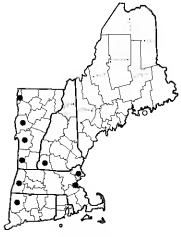
Figure 9. Distribution maps.



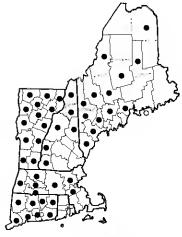
Cardamine bulbosa



Cardamine concatenata

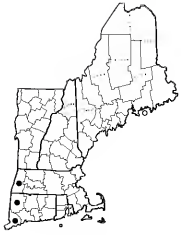


Cardamine dentata



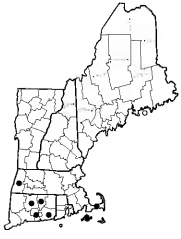
Cardamine diphylla

Figure 10. Distribution maps.

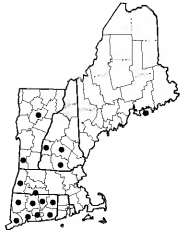


Cardamine douglasii

CARDAMINE FLEXUOSA

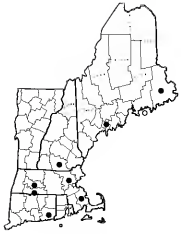


CARDAMINE HIRSUTA

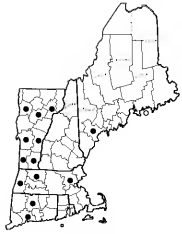


CARDAMINE IMPATIENS

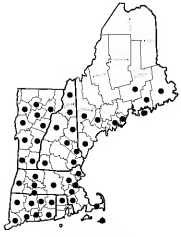
Figure 11. Distribution maps.



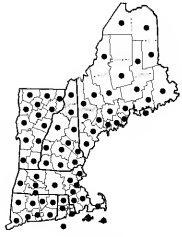
Cardamine longii



Cardamine maxima

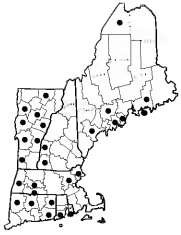


Cardamine parviflora



Cardamine pensylvanica

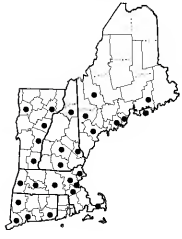
Figure 12. Distribution maps.



Cardamine pratensis

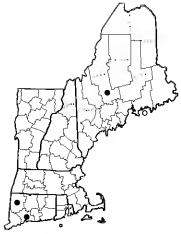
Cardamine concatenata × *C. maxima*

CHORISPORA TENELLA

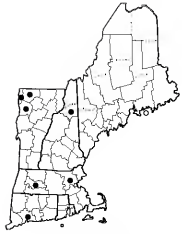


CONRINGIA ORIENTALIS

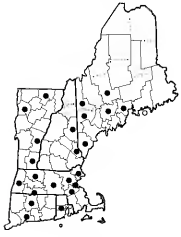
Figure 13. Distribution maps.



Descurainia incana



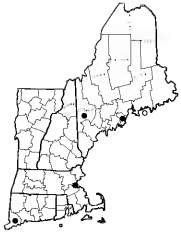
Descurainia pinnata
subsp *brachycarpa*



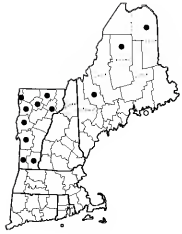
DESCURAINIA SOPHIA

DIPLOTAXIS MURALIS

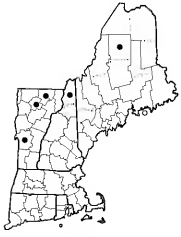
Figure 14. Distribution maps.



DIPLOTAXIS TENUIFOLIA



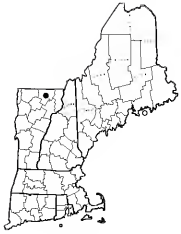
Draba arabisans



Draba cana

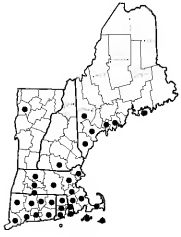
Draba glabella

Figure 15. Distribution maps.

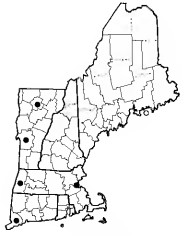


Draba incana

Draba reptans

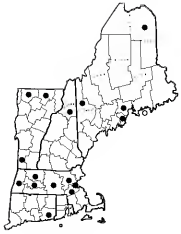


DRABA VERNA

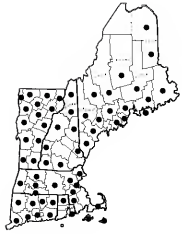


ERUCA VESICARIA
subsp. *SATIVA*

Figure 16. Distribution maps.



ERUCASTRUM GALLICUM



ERYSIMUM CHEIRANTHOIDES

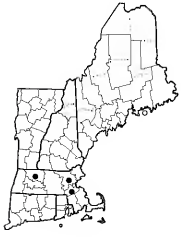
ERYSIMUM HIERACIFOLIUM

ERYSIMUM INCONSPICUUM

Figure 17. Distribution maps.

ERYSIMUM MARSCHALLIANUM

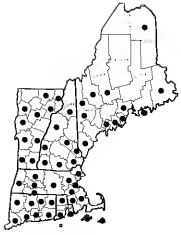
ERYSIMUM ODORATUM



ERYSIMUM REPANDUM

EUCLIDIUM SYRIACUM

Figure 18. Distribution maps.



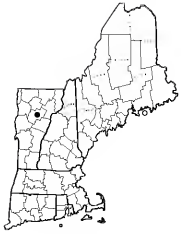
HESPERIS MATRONALIS

IBERIS AMARA

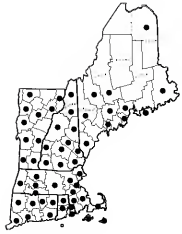
IBERIS SEMPERVIRENS

IBERIS UMBELLATA

Figure 19. Distribution maps.

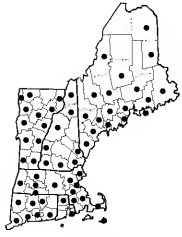


ISATIS TINCTORIA



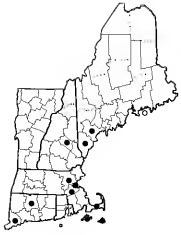
LEPIDIUM CAMPESTRE

LEPIDIUM CORONOPUS



LEPIDIUM DENSIFLORUM

Figure 20. Distribution maps.



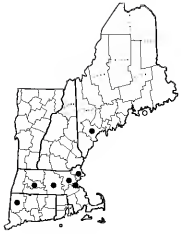
LEPIDIUM DIDYMUM

LEPIDIUM DRABA

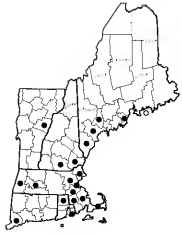
LEPIDIUM HETEROPHYLLUM

LEPIDIUM LATIFOLIUM

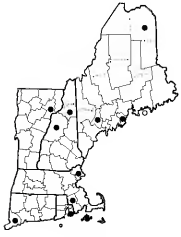
Figure 21. Distribution maps.



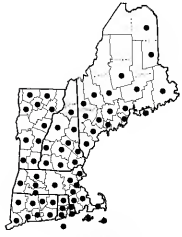
LEPIDIUM PERFOLIATUM



LEPIDIUM RUDERALE

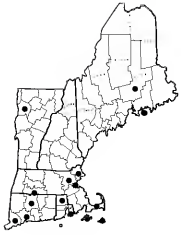


LEPIDIUM SATIVUM

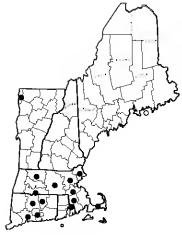


Lepidium virginicum subsp. *virginicum*

Figure 22. Distribution maps.

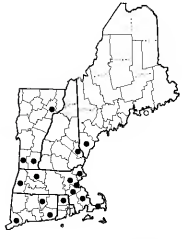


LOBULARIA MARITIMA



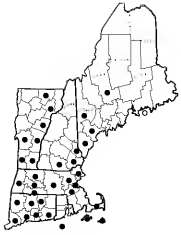
LUNARIA ANNUA

MICROTHLASPI PERFOLIATUM



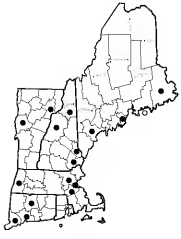
NASTURTIUM MICROPHYLLUM

Figure 23. Distribution maps.

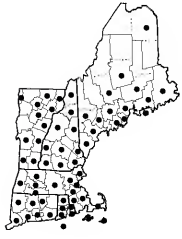


NASTURTIUM OFFICINALE

NASTURTIUM × STERILE

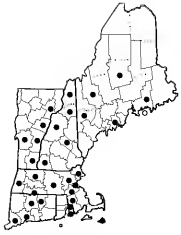


NESLIA PANICULATA



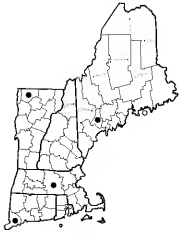
RAPHANUS RAPHANISTRUM

Figure 24. Distribution maps.



RAPHANUS SATIVUS

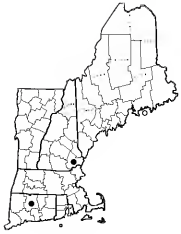
RAPISTRUM RUGOSUM



RORIPPA AMPHIBIA

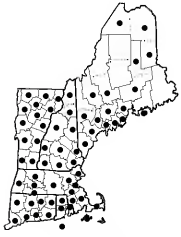
Rorippa aquatica

Figure 25. Distribution maps.

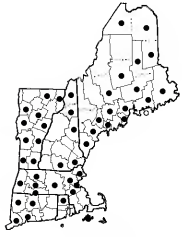


RORIPPA AUSTRIACA

RORIPPA GLOBOSA

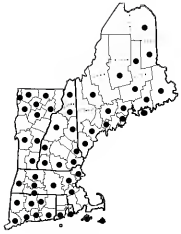


Rorippa palustris
subsp. *palustris*



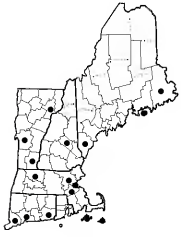
Rorippa palustris
subsp. *hispida*

Figure 26. Distribution maps.

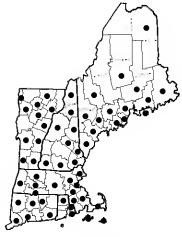


RORIPPA SYLVESTRIS

RORIPPA × PROSTRATA

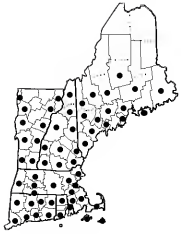


SINAPIS ALBA



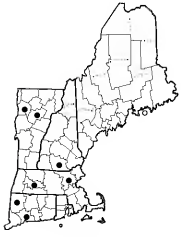
SINAPIS ARVENSIS

Figure 27. Distribution maps.

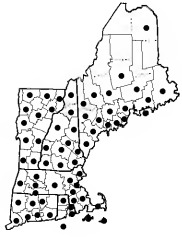


SISYMBRIUM ALTISSIMUM

SISYMBRIUM IRIO

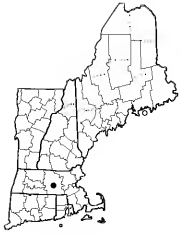


SISYMBRIUM LOESELII

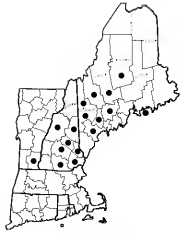


SISYMBRIUM OFFICINALE

Figure 28. Distribution maps.

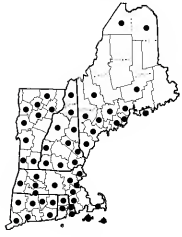


SISYMBRIUM ORIENTALE



Subularia aquatica subsp. *americana*

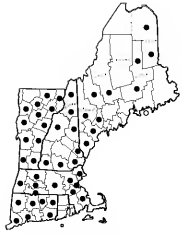
TEESDALIA NUDICAULIS



THLASPI ARVENSE

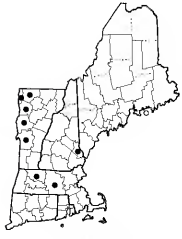
Figure 29. Distribution maps.

TROPIDOCARPUM GRACILE



Turritis glabra

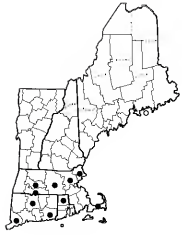
PERITOMA SERRULATA



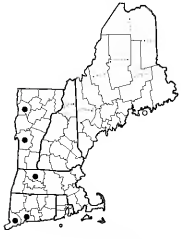
Polanisia dodecandra subsp *dodecandra*

Figure 30. Distribution maps.

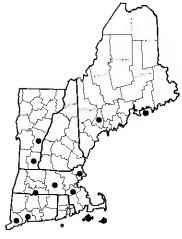
POLANISIA DODECANDRA subsp. *TRACHYSPERMA*



TARENAYA HASSLERIANA

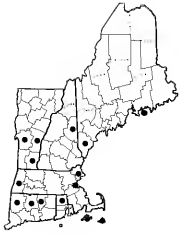


Floerkea proserpinacoides



RESEDA ALBA

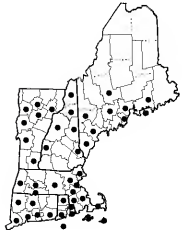
Figure 31. Distribution maps.



RESEDA LUTEA

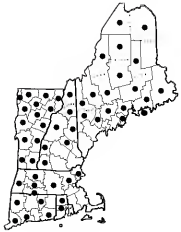
RESEDA LUTEOLA

RESEDA ODORATA

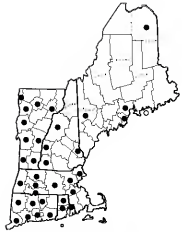


POPULUS ALBA

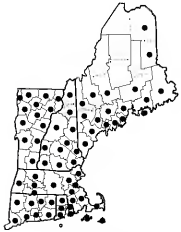
Figure 32. Distribution maps.



Populus balsamifera



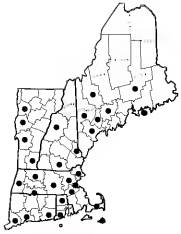
Populus deltoides
subsp. *deltoides*



Populus grandidentata

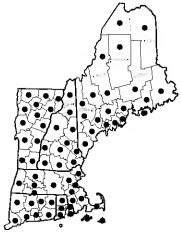
Populus heterophylla

Figure 33. Distribution maps.



POPULUS NIGRA

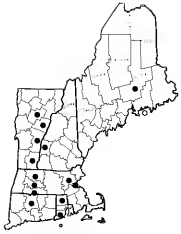
POPULUS TREMULA



Populus tremuloides

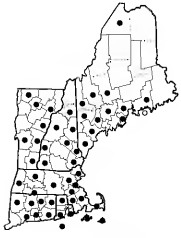
Populus x canadensis

Figure 34. Distribution maps.

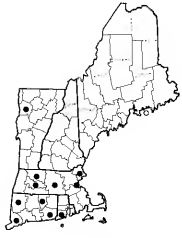


POPULUS × CANESCENS

Populus × heimburgeri

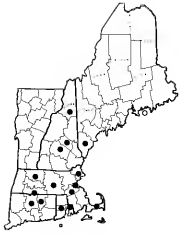


Populus × jackii

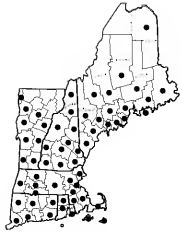


Populus × rouleauiana

Figure 35. Distribution maps.



Populus × smithii

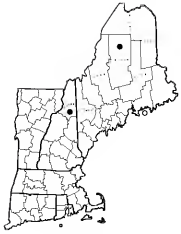


SALIX ALBA

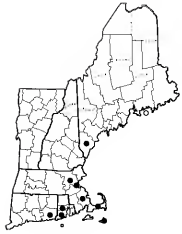
Salix amygdaloides

Salix arctophila

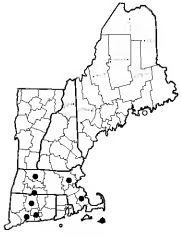
Figure 36. Distribution maps.



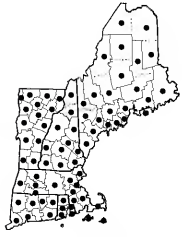
Salix argyrocarpa



SALIX ATROCINEREA

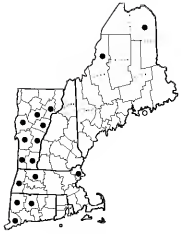


SALIX BABYLONICA



Salix bebbiana

Figure 37. Distribution maps.



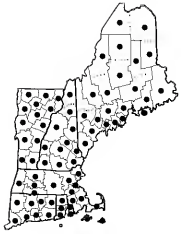
Salix candida

SALIX CAPREA

SALIX CINEREA

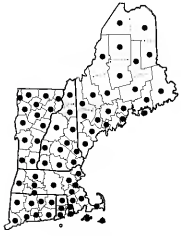
Salix cordata

Figure 38. Distribution maps.



Salix discolor

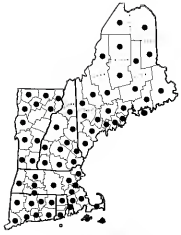
SALIX ELAEAGNOS



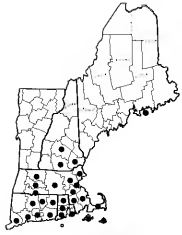
Salix eriocephala

Salix herbacea

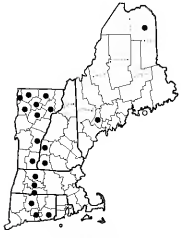
Figure 39. Distribution maps.



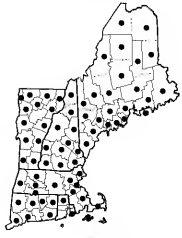
Salix humilis
var. *humilis*



Salix humilis
var. *tristis*

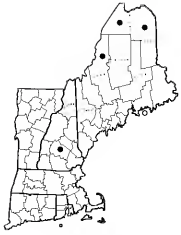


Salix interior



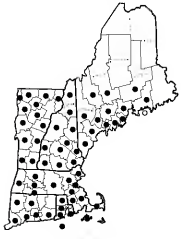
Salix lucida

Figure 40. Distribution maps.

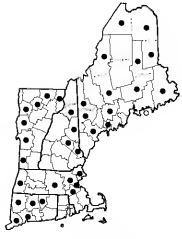


Salix myricoides

SALIX MYRSINIFOLIA

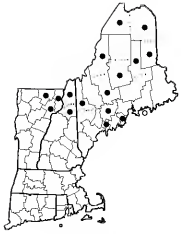


Salix nigra

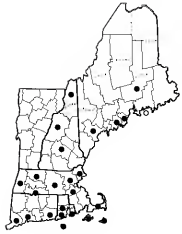


Salix pedicellaris

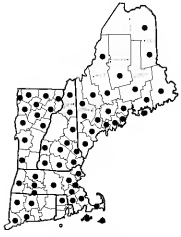
Figure 41. Distribution maps.



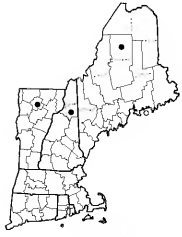
Salix pellita



SALIX PENTANDRA

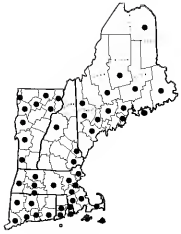


Salix petiolaris

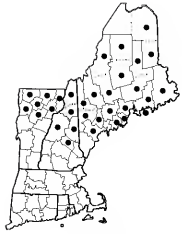


Salix planifolia

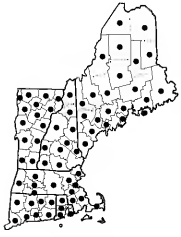
Figure 42. Distribution maps.



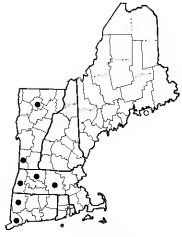
SALIX PURPUREA



Salix pyrifolia



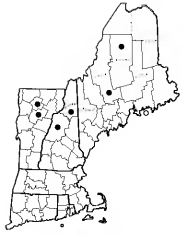
Salix sericea



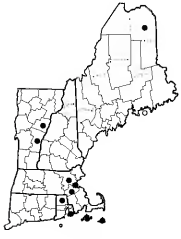
Salix serissima

Figure 43. Distribution maps.

SALIX TRIANDRA



Salix uva-ursi



SALIX VIMINALIS

SALIX ALBA
× S. petiolaris

Figure 44. Distribution maps.

Salix bebbiana
× *S. eriocephala*

Salix bebbiana
× *S. humilis* var. *humilis*

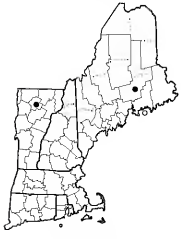
Salix bebbiana
× *S. petiolaris*

Salix × *besscheli*

Figure 45. Distribution maps.

Salix candida
× *S. pellita*

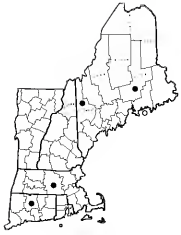
SALIX CINEREA
× *S. eriocephala*



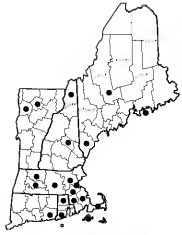
Salix cordata
× *S. sericea*

Salix × *cryptodonta*

Figure 46. Distribution maps.



Salix discolor
× *S. eriocephala*

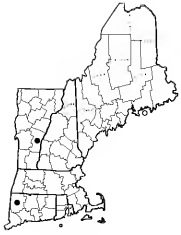


Salix discolor
× *S. humilis* var. *humilis*

Salix discolor
× *S. petiolaris*

Salix discolor
× *S. pyrifolia*

Figure 47. Distribution maps.



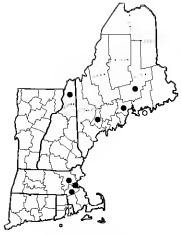
SALIX × EHRHARTIANA

Salix eriocephala
× S. lucida

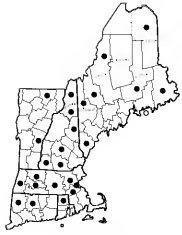
Salix eriocephala
× S. myricoides

Salix eriocephala
× S. pedicellaris

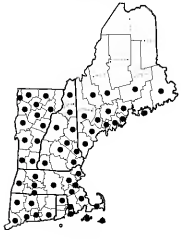
Figure 48. Distribution maps.



Salix eriocephala
× *S. petiolaris*



Salix eriocephala
× *S. sericea*



SALIX × *FRAGILIS*

Salix × *grayii*

Figure 49. Distribution maps.

Salix humilis var. *humilis* × *S. petiolaris*

Salix humilis var. *humilis* x *S. sericea*

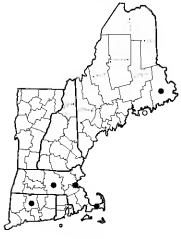
Salix humilis var. *tristis* × *S. petiolaris*

Salix × *jesupii*

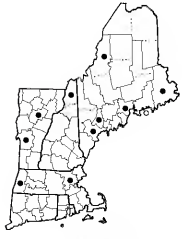
Figure 50. Distribution maps.

Salix lucida
× *S. serissima*

Salix × *peasei*



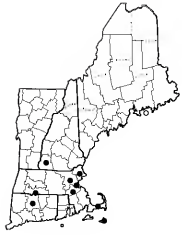
SALIX × *PENDULINA*



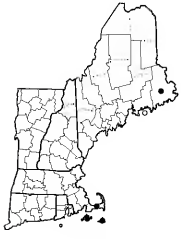
Salix petiolaris
× *S. sericea*

Figure 51. Distribution maps.

Salix × rubella



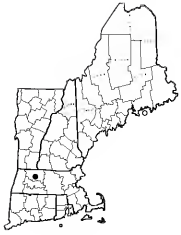
SALIX × SEPULCRALIS



SALIX × SMITHIANA

TROPAEOLUM MAJUS

Figure 52. Distribution maps.



TROPAEOLUM MINUS

Figure 53. Distribution map.

Nesom, G.L. 2011. Toward consistency of taxonomic rank in wild/domesticated Cucurbitaceae. Phytoneuron 2011-13: 1–33.
Mailed 7 March 2011.

TOWARD CONSISTENCY OF TAXONOMIC RANK IN WILD/DOMESTICATED CUCURBITACEAE

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ABSTRACT

A taxonomic review and formal nomenclatural summaries are provided for certain species and species complexes of *Citrullus*, *Cucumis*, and *Cucurbita* that occur in the FNANM region in an attempt to apply consistent taxonomic ranking to those including both wild and closely related domesticated forms. Taken here as an archetypical starting point are examples in *Cucurbita* where two paired taxa are morphologically distinct but molecularly identical or near-identical, the domesticate with some certainty derived from the wild form — these are recognized as conspecific subspecies. **Citrullus.** Molecular studies show that the lineage including the cultivated watermelon (*Citrullus lanatus* sensu stricto) and the lineage including the citron melon (*C. lanatus* var. *citroides*) have a sister relationship but distinct haplotypes, and they apparently diverged from a common ancestor between 0.6–0.9 million years ago. The citron melon is appropriately recognized at specific rank — as *Citrullus caffer* Schrad. — rather than a variety of *C. lanatus*. At varietal rank, it is commonly identified as *Citrullus lanatus* var. *citroides* (L.H. Bailey) Mansf., but the correct name instead is *Citrullus lanatus* var. *caffrorum* (Alef.) Fosberg. A lectotype is designated for *Citrullus caffer* Schrad. and for *Citrullus vulgaris* var. *citroides* L.H. Bailey, and a photograph of each type is provided. The sister and probable progenitor of cultivated watermelons (subsp. *lanatus*) apparently is similar to west African wild types identified as *C. lanatus* subsp. *mucosospermus*. **Cucumis.** Cultivated forms of *Cucumis melo* (e.g., canteloupe) have long been known to be similar to morphologically distinct wild and feral races generally identified as *C. melo* subsp. *agrestis* and recent studies have confirmed their molecular identity or near-identity. The forms comprising subsp. *melo* are known strictly as cultivars and almost certainly have arisen from subsp. *agrestis*, thus their taxonomic treatment as conspecific subspecies is appropriate, although multiple independent domestications from within subsp. *agrestis* complicate the interpretation. The domesticated *Cucumis sativus* sensu stricto and the free-living *C. hardwickii* are closely related and perhaps justifiably interpreted as sister taxa. *Cucumis sativus*, however, is highly variable in morphology and some feral expressions intergrade with *C. hardwickii*, but the latter is isozymically distinct and its recognition at varietal rank seems appropriate, as *C. sativus* var. *hardwickii*. The relationship apparently is not one of wild progenitor/domesticate. **Cucurbita.** Closely related pairs of *Cucurbita* taxa (regarded as wild progenitor/domesticate) with identical haplotypes and hypothesized to have diverged in response to artificial selection are treated as conspecific subspecies — e.g., *C. argyrosperma* (1866, cultivated) includes *C. sororia* (1943, wild) as *C. argyrosperma* subsp. *sororia*. *Cucurbita pepo* sensu stricto comprises cultivars and landraces of southern Mexico and Guatemala and its wild ancestor has not been identified. Its haplotype differs from plants of the eastern USA and northeastern Mexico generally treated as *C. pepo* subsp. *ovifera*, from which a separate group of domesticates has arisen. Subsp. *ovifera* (nom. superfl. illeg.; the earlier subsp. *texana* is correct) is treated here at specific rank, as *Cucurbita melopepo* L., including var. *melopepo* (the domesticates), **var. ozarkana** (Decker-Walters) G.L. Nesom, comb. nov., **var. texana** (Scheele) G.L. Nesom, comb. nov., and **var. fraterna** (L.H. Bailey) G.L. Nesom, comb. nov. A lectotype is designated for *C. melopepo* L. and for *C. pepo* var. *condensa* L.H. Bailey. **Subsp. texana** (Scheele) G.L. Nesom, comb. nov., includes var. *texana*, var. *ozarkana*, and var. *fraterna*; **subsp. melopepo** includes var. *melopepo*.

KEY WORDS: *Citrullus*, *Cucumis*, *Cucurbita*, taxonomic rank, typification

In preparation of the taxonomic treatment of Cucurbitaceae for the Flora of North America North of Mexico, inconsistencies became apparent in concepts of species and infraspecific taxa, including cultivars and cultivar groups. Differences in biology and patterns of evolution, as well as degrees of subjectivity in judgement, make it difficult to apply a consistent system of taxonomic ranks across all genera. Nevertheless, whatever consistency can be attained is useful.

Emphasizing examples from the Cucurbitaceae, Jeffrey (1968) proposed a system for cultivated plants that incorporates a hierarchy of names — species, subspecioid, convar, provar, and cultivar. Similarly, Grebenscikov (1953) presented a detailed hierarchical classification for *Cucumis* cultivars, but mostly, even in the Cucurbitaceae, application of horticultural names seems to have remained somewhat idiosyncratic from one genus to the next. The current review deals primarily with names and ranks that are applicable at levels where both wild plants and horticultural taxa are involved in the classification.

Particularly challenging for classification are instances where a wild progenitor/domesticated derivative relationship (e.g., see Crawford 2010) is hypothesized to exist as a result of artificial selection. Taken here as an archetypical starting point, an incipient convention, for consistency are several examples in *Cucurbita* (see details below) where two paired taxa are morphologically distinct but molecularly identical or near-identical, the domesticate with some certainty derived from the wild form. These are recognized as conspecific subspecies.

1. CITRULLUS

Molecular studies have shown that the cultivated watermelon, *Citrullus lanatus* (Thunb.) Matsum. & Nakai sensu stricto, and the citron melon, generally identified as *C. lanatus* var. *citroides* (Bailey) Mansf., represent closely related but distinct lineages (Navot & Zamir 1987; Jarret & Newman 2000; Levi et al. 2001; Dane & Lang 2004; Dane et al. 2004; Dane & Liu 2007; Mujaju et al. 2010). The two taxa have distinct haplotypes and appear to have evolved from a common ancestor perhaps closely similar to *C. ecirrhosus* Cogn., with which they share several substitutions and indels at non-coding cpDNA regions (Dane & Lang 2004). This evolutionary divergence is estimated to have occurred at least 0.8–0.9 million years ago (Dane & Lang 2004) or at least 0.6 million years ago Dane & Liu 2007).

In *Citrullus* as a whole, which includes 5 species (as interpreted here), two main clades are evident: (a) *C. colocynthis* (L.) Schrad. (the bitter apple) and (b) a lineage in which *C. rehmii* De Winter is sister to a clade comprising *C. ecirrhosus* and *C. lanatus* sensu lato (Dane & Lang 2004), the latter regarded here as *C. lanatus* sensu stricto plus var. *citroides* (see comments below). An earlier ITS analysis of *Citrullus* phylogeny, however, placed *C. rehmii* as sister to *C. lanatus* sensu lato (Jarret & Newman 2000), and Dane et al. (2004) found that *C. rehmii* showed almost the same haplotype as *C. lanatus* var. *citroides* with the exception of a unique insertion at a cpSSR site. *Citrullus rehmii* (annual) and *C. ecirrhosus* (perennial) are endemic to the Kalahari Desert region of Namibia.

***Citrullus lanatus* sensu stricto — domesticated sweet melons and the egusi-type melons.**

Citrullus lanatus sensu stricto includes two morphological types — subsp. *lanatus* (the cultivated, dessert watermelons, including red sweet watermelon; Fig. 5) and subsp. *mucosospermus* Fursa (the egusi-type melons, including wild, semi-cultivated, and cultivated forms in west Africa, which are grown primarily for their large, soft, oil- and protein-rich seeds). The egusi melons are relatively small and have white, bitter flesh similar to the citron melons, but the egusi/citron similarities apparently are plesiomorphic.

The cultivated watermelon and the egusi-type melon have the same cpDNA haplotype. Both are reported to lack molecular variation at cpDNA regions (Dane & Lang 2004) and also have a narrow genetic base in other kinds of assessments (e.g., Levi et al. 2001; Levi & Thomas 2005). Mujaju et al. (2010), however, reported that cultivated sweet melons in Zimbabwe are as diverse molecularly as the citron melons; Nimmakayala et al. (2010) identified 583 AFLP bands that are polymorphic within var. *lanatus*; Levi et al. (2004) found high polymorphisms among watermelon heirloom cultivars using inter-simple sequence repeat (ISSR) and amplified fragment-length polymorphism (AFLP) markers.

***Citrullus lanatus* var. *citroides* — citron melons and tsamma melons.**

Fursa (1972) recognized another entity closely similar to var. *citroides* — *C. lanatus* var. *caffer* (see nomenclature below), the wild "tsamma" melon of the Kalahari Desert. cpDNA studies, however, have shown that when the citron/tsamma melons are considered together, three haplotypes exist among them (Dane & Liu 2007). These three entities apparently have not been unambiguously recognized by formal nomenclature, or at least the genetic affinities of names potentially associated with these haploptypes are not known. The ancestral citron/tsamma haplotype is known from Swaziland and South Africa; each of the other two ranges across southern Africa. A number of distinct landraces that are cultivated in Kalahari region (including the tsamma melons) may represent early forms of domestication, as also suggested by Maggs-Kolling et al. (2000).

Two species rather than one.

The domesticated watermelon and the primarily wild-type egusi melon, which are identical in cpDNA haplotype and essentially so in other molecular features, are recognized here as conspecific subspecies within *Citrullus lanatus*. The citron/tsamma melon, divergent both morphologically and molecularly from *C. lanatus*, is recognized as a separate species.

At specific rank, the citron/tsamma melons are correctly identified as *Citrullus caffer* Schrad. ex Eckl. & Zeyh., 1834; if at varietal rank, then as *C. lanatus* var. *caffrorum* (Alef.) Fosberg. The epithet "caffrorum" at varietal rank was first validly published by Alefeld in 1866 as "*Citrullus vulgaris* var. *caffrorum*," preceding Bailey's proposal of "*Citrullus vulgaris* var. *citroides*" in 1930.

In the USA, the two species can be distinguished by the following contrasts.

1. Leaf blades ovate to lanceolate-ovate or ovate-triangular in outline, mostly 8–20 cm; fruits globose to oblong-ellipsoid, 12–35 cm (or more) in diam., rind hard but not durable, flesh juicy, red, yellow, or greenish, sweet; seeds commonly black ..... **Citrullus lanatus**
1. Leaf blades ovate in outline, 3–10(–14) cm; fruits globose to globose-ovoid, 14–25 cm in diam., rind hard and durable, flesh dry, whitish, bitter; seeds tan to brown or reddish ..... **Citrullus caffer**

Without mature fruits, the distinction may be difficult. Leaf shape seems generally to separate them, but leaves overlap in size and shape. Stems are villous in both species. Habitat is a good clue, since *C. lanatus* is almost always found where seeds were recently discarded by people and the plants rarely if ever form reproductive populations. *Citrullus caffer* is free-living and occurs in a wider range of habitats.

Several African accessions morphologically identified as *Citrullus caffer* were found to have the cpDNA haplotype of *C. lanatus* (Dane et al. 2004; Mujaju et al. 2010), possibly as a result of introgression, and Levi et al. (2001) found four plants of *C. lanatus* with genes perhaps introgressed from *C. caffer* (three from Africa, one from China). The citron melon also has been observed to form spontaneous hybrids with *C. colocynthis* (bitter apple) — in the USA (Fulks et al. 1979), in India (Singh 1978), and in Australia (Herrington et al. 1986).

CITRULLUS LANATUS (Thunb.) Matsum. & Nakai, Cat. Sem. Spor. Hort. Bot. Univ. Imp. Tokyo 30, no. 854. 1916. *Momordica lanata* Thunberg, Prodr. Pl. Cap. 1: 13. 1794. **TYPE**: South Africa, Cape Province (as cited by Jeffrey 1967) (holotype: UPS-THUNB microfiche!). The protologue has only this: "M. [Momordica] foliis ternato-pinnatifidis scabris, fructo lanato."

a. SUBSPECIES LANATUS

Cucurbita citrullus L., Sp. Pl. 2: 1010. 1753. *Anguria citrullus* (L.) Mill., Gard. Dict. (ed. 8). 1768. *Cucumis citrullus* (L.) Ser. in DC., Prodr. 3: 301. 1828. *Citrullus citrullus* (L.) H. Karsten, Deut. Fl. [Pharm. med. Bot.] 889. 1882. *Colocynthis citrullus* (L.) Kuntze, Rev. Gen. Pl. 1: 256. 1891. **TYPE**: [Italy.] "Apulia, Calabria, Sicilia" Not designated (fide Jarvis 2008). As noted by Jarvis, Jeffrey (1967) designated as lectotype: LINN-1151.5 (digital image!), but this was not original material for the name. Recognizing this, Jeffrey later noted (1980, p. 791) that "This is perhaps better to be regarded as a neotype, since although annotated as this species by Linnaeus, it may not have been studied by him prior to the writing of the 'Species Plantarum.'" Jarvis, however, observed that because original material is in existence, designation of LINN-1151.5 as a neotype would be contrary to ICBN Art. 9.11.

Citrullus vulgaris Schrad., Linnaea 38: 413. 1838 (not Enum. Pl. Afric. Austral. 2: 279. 1836). *Citrullus lanatus* subsp. *vulgaris* (Schrad. ex Eckl. & Zeyh.) Fursa, Bot. Zhurn. (Moscow & Leningrad) 57: 37. 1972. Apparently intended by Schrader as a replacement name for *Cucurbita citrullus* L. The full 1836 entry for the species is this: "1790. CITRULLUS *vulgaris* Schrad. Mss. Cucurbita citrullus L., sp. 1435. — In cultorum vicinitate intra coloniam sponte quasi proveniens. Ex Europa illatus. Jan."

Authorities of names in *Citrullus* proposed in Ecklon & Zeyher's Enumeratio Plantarum Africae Australis Extratropicae sometimes have been cited as "Schrader ex Ecklon & Zeyher" but the author of the whole Cucurbitaceae treatment (pp. 275–280) is explicitly noted (p. 275) to be H.A. Schrader. Morphological descriptions were provided for *Citrullus* (the genus) and *Citrullus amarus*, thus the authority for those is correctly cited as "Schrad. in Eckl. & Zeyh." or simply as "Schrad." *Citrullus vulgaris* and *Citrullus caffer* were not validly published until 1838 in a posthumous manuscript, with the authority from that publication also as "Schrad." or "Schrad. in Schlecht." (Linnaea vol. 38, see notes below).

b. SUBSPECIES MUCOCOSPERMUS

Citrullus lanatus subsp. *mucosospermus* Fursa, Bot. Zhurn. (Moscow & Leningrad) 57: 38. 1972. *Citrullus mucosospermus* (Fursa) Fursa, Trudy Prikl. Bot. Genet. Selek. 81: 111. 1983. **TYPE** (as cited by Fursa 1972): **Ghana**. [No specific locality cited], 5 Aug 1957, *N.P. Oltarshevskyi 3833* (WIR, cat. num. WIR k-3742).

CITRULLUS CAFFER Schrad., Linnaea 12: 413. 1838. *Citrullus vulgaris* var. *caffrorum* Alef., Landw. Fl., 210. 1866. *Citrullus lanatus* var. *caffer* (Schrad.) Mansf., Kulturpfl., Beiheft 2 [Verzeichnis], 421. 1959. *Citrullus lanatus* var. *caffrorum* (Alef.) Fosberg in Fosberg & Sachet, Smithsonian Contr. Bot. 45: 15. 1980. **LECTOTYPE** (designated here): probably from the Göttingen Botanical Garden, herbarium of C.A. Fischer (GOET 007221!, Fig. 1; isolectotypes: GOET 007222!, GOET 007223!, Figs. 2 and 3). These three sheets were separated and mounted from a folder in the herbarium of C.A. Fischer (1785-1836), Inspector of the Göttingen Botanical Garden ca. 1821-1836 — his herbarium was accessioned by GOET in 1837 (J. Heinrichs, GOET Curator, pers. comm. 2011).

Schrader first published the name *Citrullus caffer* in a seed catalogue (Ind. Sem. Hort. Goetting., 2. 1834), indicating that the name was based on "*Cucurbita caffra* Eckl." from another 1834 seed catalogue (Coll. Sem. Capensium), with the implication that original

material should be sought among collections by Ecklon or Ecklon & Zeyher. A still later entry by Schrader (in Ecklon & Zeyher's Enum. Pl. Afric. Austral. 2: 279. 1836), however, cited both names from 1834, implying that the concept of original material would be broadened to include specimens seen by Schrader, especially since the name is formally credited only to him.

The entry in Index Seminum Horti Academici Gottingensis, 1834: "*Citrullus caffer* Schrad. Synonym. est: *Cucurbita caffra* Eckl. coll. sem. capensium. Plura de hac aliisque Cucurbitaceis alio loco." This seed catalogue entry was quoted in Linnaea 10 (Litteratur-Bericht 1835 & 1836]: 109. 1836. Provided by the Editor, D.F.L. von Schlechtendal). It seems that Schrader in 1834 was acknowledging that his use of the epithet was based on the slightly earlier seed catalogue publication by Ecklon [& Zeyher] of *Cucurbita caffra* (see below), thus implying that the name in *Citrullus* would be correctly cited as *C. caffer* (Eckl.) Schrad., 1834. This interpretation also is indicated by the 1836 entry in Enum. Pl. Afric. Austral. — "ind. sem. hort. Goetting. 1834" was cited as the place of publication of *Citrullus caffer*, and immediately following that, the citation continues with "*Cucurbita caffra* Eckl. et Zeyh. coll. sem. 1834."

Peter Goldblatt (pers. comm.) notes that he does not know about the "sem. capensium" catalogue but that "Ecklon and Zeyher distributed herbarium collections and seeds under names they often invented or had in mind to publish. Quite a few of their names remain 'in manuscript'." The Goettingen seed catalogue provided neither a description nor specimen citation for *Citrullus caffer*, and it is assumed here that the entry in the "Capensium" catalogue was similar.

In any case, neither of the seed catalogue entries for *Citrullus caffer* in 1834 nor the entry in 1836 provided a description and the name was not validly published until 1838. Shortly after Schrader's death in 1836, a brief biography — with various incomplete taxonomic manuscripts appended, including one on Cucurbitaceae —was published in Linnaea, presumably by the editor Schlechtendal (Reliquiae Schraderianae. Linnaea 38: 353–476. 1838; Cucurbitaceae, pp. 401–423). There, a morphological description of *C. caffer* was provided. Reliquiae Schraderianae also was published as a separate in 1838 (see Google Books).

In the 1836 entry for *Citrullus caffer*, the provenance was cited as "In cultis provinciarum 'Uitenhage et Albany' et in terra 'Kafferland.' Jan. Incolis: 'Kafferwatermelon.'" "Caffraria (Cafferland and variants) was the eastern part of 'Cape Colony' and is now Eastern Cape Province. Uitenhage was the first town there and usually meant in that district. Albany was one of magisterial districts in past time (of Cape of Good Hope), when it was a province of South Africa and no longer has any political meaning" (Peter Goldblatt, pers. comm., February 2011).

In treating this entity as "var. *caffrorum*" within *Citrullus vulgaris*, Alefeld (1866) cited *Citrullus caffrorum* Schrader and *Cucurbita caffra* Eckl. & Zeyh. immediately following his proposal of the varietal name, which presumably was intended to be homotypic with both of the latter names.

The epithet "caffrorum," however, appeared in Schrader's 1838 entry (Linnaea 12: 413. 1838) for *Citrullus caffer* — as "2. *Citrullus* (C. caffrorum) caffer." — and it is not clear why Schrader included the parenthetical element, especially since immediately following in the entry was the citation "Curcurbita caffra Eckl. et Zeyh. Coll. sem. 1833 seq. Verz. 1833." It might appear that Schrader was attempting to correct his earlier citation of the Eckl. & Zeyh. name from an 1834 seed catalog, with the intention of attributing authorship of the basionym to Ecklon & Zeyher, again indicating the correct name to be "*Citrullus caffer* (Eckl. & Zeyh.) Schrad., 1834." In any case, it appears that "caffrorum" as an epithet at varietal rank was first validly published by Alefeld in 1866 (as also explicitly interpreted by Fosberg, who noted "Var. *caffrorum* Alefeld here lectotypified by *Cucurbita caffra* Ecklon &

Zeyher seems to be the earliest varietal epithet for the common red-fleshed cultivated watermelon."). Fosberg's interpretation of the biological identity this entity was mistaken, as these names refer to the citron melon, but at varietal rank within *Citrullus lanatus*, the correct name for the citron melon is *C. lanatus* var. *caffrorum* (Alef.) Fosberg.

Citrullus vulgaris var. *citroides* L.H. Bailey, Hortus (ed. 1), 152. 1930. *Citrullus lanatus* var. *citroides* (L.H. Bailey) Mansf., Kulturpfl., Beiheft 2 [Verzeichnis], 421. 1959. *Citrullus colocynthoides* var. *citroides* (L.H. Bailey) Millan, Darwiniana 14: 697. 1969. **LECTOTYPE** (designated here): **[USA. Colorado.]** "Trade or Label Name: Citron," *Dreer 536*, cultivated at Ithaca, N.Y., [collected, presumably, by L.H. Bailey] 20 Sep 1930 (BH digital image!; Fig. 4). This label also is annotated at the top with "photo." Packet attached. The protologue has only this: "Var. **citroides**. CITRON OR PRESERVING MELON. Fr. small, with white hard flesh, used only for preserving; seeds not marked or marbled (as they usually are in watermelon)."

The original publication of var. *citroides* has been generally cited as "Gentes Herb. 2: 186. 1930," but in that publication Bailey provided neither a description nor type citation, noting (p. 186) that "the var. was included in a brief account of *Citrullus* for Hortus, and [the] type has now been plated and the page released for printing although the present paper will be actually published in advance of that book."

Several sheets at BH are possibly interpreted as original material of var. *citroides*. The label heading of the 1889 specimen is "Garden Herbarium of Cornell University Experiment Station;" the others have "Herbarium of L. H. Bailey."

1. Identified as "*Citrullus vulgaris* Schrad.," Trade or Label Name: Colorado Citron, University Garden. Sept 15, 1889.

2. Trade or Label Name: Citron, *Dreer 536*, Cultivated at Ithaca, N.Y., Sown May 6, [coll.] Sept 15, 1930.

3. Trade or Label Name: Citron, *Dreer 536*, Cultivated at Ithaca, N.Y., [coll.] Sept 20, 1930, This label also is annotated at the top with "photo." Packet attached.

4. Identified as "*Citrullus vulgaris* Schrad. var. *citroides* Bailey," Trade or Label Name: Colorado Preserving Citron, *Dreer 536*, Sown May 25, coll. July 4, 1938, Ithaca.

5. Trade or Label Name: Colorado Preserving Citron, *Dreer 536*, [coll.] Sept 22, 1938, Ithaca.

Seeds from which collections 2-5 were grown apparently were made as one gathering either by Henry A. Dreer (1818-1873), who operated a seedhouse and nursery in Philadelphia, or his son, William F. Dreer (1849-1918), who ran a large nursery in Riverton, New Jersey, and left an annual endowment to the Cornell Horticulture Department. At least one other specimen grown from seeds from H.A. Dreer is in the BH herbarium (see *Cucurbita* notes below). It is possible that collection 1 was grown from the same lot, as both it and collection 5 are noted to be the "Colorado Citron." In any case, collection 4 is the only one identified as "var. citroides," but neither it nor collection 5 was made until after publication of the name. Presumably collections 2 and 3 were those that Bailey would have regarded as type material, and collection 3 is designated here as the lectotype. With his long-standing interest in Cucurbitaceae, Bailey himself probably made the herbarium collections; it apparently is his handwriting on the labels.

Citrullus colocynthoides Pangalo, Bull. Applied Bot., Leningrad 1929-30, 23, 3: 66 [Trudy Prikl. Bot. 23(3): 66]. 1930 [not "*Citrullus vulgaris colocynthoides* Schweinf. 1883!," as noted by Mansfeld 1959, p. 421). **TYPE**: not seen, presumably at WIR. The Biodiversity Collections

Index indicates that specimens of K.I. Pangalo are in the herbarium of the N.I. Vavilov Institute of Plant Industry (WIR).

In a note below the entry for *Citrullus vulgaris* var. *citroides*, Bailey (1930, p. 186), observed the following: "I now find that the watermelon has been newly studied in Russia and the papers are just at hand after my account is ready (Bulletin No. 3 of Applied Botany and New Cultures, Leningrad, 1930). Perhaps the species, *Citrullus colocynthoides*, there proposed by K.I. Pangalo, includes the garden preserving citron here named *Citrullus vulgaris* var. *citroides*; that new species includes "citron forage watermelons," growing of their own accord in the southern part of Soviet Russia something like a weed, nobody cultivating them, recently utilized as forage plants. The illustration of the fruits of these spontaneous melons shows some of them to be externally like the American garden citron melon and others very different from anything I have seen. It will be interesting to determine, if possible, whether the preserving citrons originated from Russian or Asian stocks. The name *colocynthoides* is proposed as an independent species of *Citrullus*, not as a var. of *Citrullus vulgaris*, and therefore it and var. *citroides* are not in nomenclatorial conflict, even though we may find (as I suspect) that the American and Russian plants are equivalent for purposes of systematic diagnosis."

Citron melons have not been commonly documented as naturalized in the USA, but they appear to be scattered as weeds in pinelands, sandy fields, cotton fields, and orange groves, and along roadbanks, railroad banks and tracks, and roadsides and other disturbed sites; known from collections and literature from Arizona, California, Florida, New Mexico, Nevada, and Texas (Fulks et al. 1979; Grichar et al. 2001; Stephens 2003; Hall et al. 2004). In addition to citron melon, vernacular names for *Citrullus caffer* in English-speaking countries are red-seeded citron, preserving melon, jam melon, and stock melon.

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2. CUCUMIS

Only two formal infraspecific taxa within *Cucumis melo* were recognized by Kirkbride (1993), following an earlier informal proposal by Jeffrey (1980a) — subsp. *melo* and subsp. *agrestis*. Grebenscikov (1953) recognized *C. melo* and *C. agrestis* at specific rank and arranged many other infraspecific taxa in a hierarchical system of horticultural names. Kirkbride also suggested that other variants described within *C. melo* should be treated with horticultural names, and classification of melons into two major lineages has been generally supported by molecular phylogenies (e.g., Stepansky et al. 1999; Decker-Walters et al. 2002). **Subsp. *melo*** comprises the large-fruited, sweet

"dessert" melons of commerce (canteloupe, honeydew, and muskmelon, and the snake melon/ cucumber melon) — var. *melo* (including var. *cantalupo*), var. *inodorus*, and var. *flexuosus* — originating mostly in western Asia and Europe, all known strictly as cultivars. Molecular resolution between var. *cantalupo* and var. *inodorus* is slight (Staub et al. 1997; Silberstein et al. 1999; Stepansky et al. 1999), despite significant differences between them in morphology and physiology. **Subsp. *agrestis*** comprises a group of cultivars and landraces, as well as free-living wild forms and feral forms, essentially the generally smaller, mostly non-sweet, and morphologically more variable types, which originated mostly in India and southeast Asia.

The two taxa are distinguished by these contrasts.

1. Hypanthium or youngest fruits pilose to lanate with spreading hairs; stems glabrous sparsely villous; fruit greater than 10 cm in diam., in cultivated forms commonly fragrant and sweet ..... **Cucumis melo** subsp. **melo**
1. Hypanthium and youngest fruits retrorsely or antrorsely sericeous with short appressed hairs; stems hispid with retrorse hairs; fruit 2.5–5 cm in diam., mostly not fragrant and not sweet, but with numerous exceptions ..... **Cucumis melo** subsp. **agrestis**

Statements that wild forms exist in both subspecies (e.g., Jeffrey 1980b; Zohary & Hopf 1983; Stepansky et al. 1999; Pitrat et al. 2000) appear to have been based on taxonomic arrangements that regard the Himalayan entities *Cucumis trigonus* Boiss. and *C. callosus* (Roettl.) Cogn. & Harms as synonyms of *C. melo* subsp. *melo*. Parthasarathy & Sambandam (1980) found that crosses between *C. melo* (presumably subsp. *melo*) and plants identifiable as *C. callosus* resulted in abundant and fully fertile seeds and F_1s with normal meiosis; they concluded that *C. callosus* (with *C. trigonus* as a synonym) does not warrant separate species status and is "nothing but a progenitor of *C. melo*."

Jeffrey (1980b) noted that *Cucumis callosus* is a synonym (a "tropical wild variant") of *Cucumis melo*, while Chakravarthy (1982) treated *C. callosus* as a distinct species. Verma and Pant (1985) treated *C. trigonus* as a synonym of *C. callosus*, but Matthew (1983) regarded *C. trigonus* as a distinct species of peninsular and western India. Earlier, Clarke (1879) treated *C. melo* var. *agrestis* as a synonym of *C. trigonus* and noted that *C. melo* is "perhaps the cultivated form of *C. trigonus*." Nazimuddin and Naqvi (1984) regarded *C. callosus* and *C. trigonus* both as synonyms of *C. melo* var. *agrestis*. Diversity and ambiguity of interpretation are widespread.

Recent study by Sebastian et al. (2010) indicates that both *Cucumis trigonus* and *C. callosus* are morphologically distinct species (morphology not discussed in their report) but with DNA sequences "nearly identical to those of *C. melo*." They observed (p. 1472) that *C. trigonus* and *C. callosus* "likely represent the wild progenitor of cultivated melon." Their cladogram, however, appears to show samples of subsp. *agrestis* and subsp. *melo* in a sister relationship, more closely related to each other than to *C. trigonus* and *C. callosus*. Perhaps a more accurate summary of their portrayal would be that the wild progenitor of cultivated melon (*C. melo* subsp. *melo*) is equally as likely to be represented by *C. trigonus* and *C. callosus* as by free-living forms of subsp. *agrestis*.

With acceptance of *Cucumis trigonus* and *C. callosus* as distinct species, patterns of diversity in landraces of subsp. *agrestis* need to be reexamined in terms of taxonomic recognition and rank. Landraces of *Cucumis melo* in south and eastern Asia (including India) show a high level of variation isozymes, DNA, and morphology (Sujatha et al. 1991; Akashi et al. 2002; Dhillon et al. 2007; Tanaka et al. 2007; Dwivedi et al. 2010) and some of them might ultimately be recognized at higher rank. As best I can infer, if *C. trigonus* and *C. callosus* are accepted as distinct species, it appears that no wild forms are represented within subsp. *melo*. Wild forms and apparently primitive expressions exist in several lineages of subsp. *agrestis*.

Taxonomic rank of subsp. *agrestis*.

If recognized at specific rank in order to emphasize an evolutionary and taxonomic status coordinate with that of *Cucumis trigonus* and *C. callosus*, the correct name of subsp. *agrestis* would be *Cucumis dudaim* L. (see below). It seems likely, however, that cultivars of subsp. *melo* have been derived from one expression or another of subsp. *agrestis*, and treatment of the two as a conspecific subspecies parallels that of wild progenitor/domesticated derivative pairs in *Cucurbita*.

On the other hand, the molecular identity (or near-identity) of subsp. *agrestis* and subsp. *melo* apparently is matched in various other pairs/groups of accepted wild species within *Cucumis* (Ghebretinsae et al. 2007; Schuman et al. 2007; Renner et al. 2007), thus the biological rationale for assigning rank is not exactly analogous to *Cucurbita*. Further, sterility barriers in *Cucumis* exist only between species groups rather than species — Jeffrey (1980a) formally divided *Cucumis* into five cross-sterile species groups within two subgenera.

The occurrence of sweet-fruited genotypes at least in vars. *agrestis* and *conomon* of subsp. *agrestis* indicates that multiple domestications have occurred in parallel with domestication in subsp. *melo* (Jeffrey 1980a; Stepansky et al. (1999); Pitrat et al. 2000; Sebastian et al. 2010). Stepansky et al. (1999) suggested that occasional occurrence of sweet *agrestis* fruits also may have resulted from hybridization between wild and feral genotypes with sweet or vegetable landraces. Parallel trends among entities in the two subspecies also exist in vestiture, fruit morphology, duration, and sexuality. *Cucumis melo* var. *flexuosus* is variable in hypanthium vestiture but molecular data place it within subsp. *melo* (Silberstein et al. 1999; Stepansky et al. 1999; López-Sesé et al. 2003). Further sampling will be necessary to assess the potential pattern of independent domestications.

Status of *Cucumis melo* var. *texanus*.

A landrace of *Cucumis melo* subsp. *agrestis* — *C. melo* var. *texanus* Naud. — is widespread and relatively abundant in the southeastern USA (Nesom 2011 and references therein). Morphological and molecular data (Decker-Walters et al. 2002) indicate that var. *texanus* has differentiated there in situ but shows the greatest genetic affinities to var. *chito* and to cultivars from Eastern Asia, including var. *conomon*. Stepansky et al. (1999) found var. *conomon* to be strongly differentiated from other varieties within subsp. *agrestis* (vars. *agrestis*, *chito*, *dudaim*, and *momordica*). Relationships among the latter four taxa are less strongly resolved on the basis of morphological and molecular data.

Among possible scenarios for the origin of var. *texanus* in the Western Hemisphere (see Decker-Walters et al. 2002) is that its progenitor was brought in by humans intentionally (perhaps by Asian immigrants) or unintentionally (as seeds mixed with those of other introduced crops). Given the distinctive genetic differentiation of var. *texanus*, the time of its introduction likely was pre-Columbian. Decker-Walters et al. also noted (p. 194) that "The relatively uniform morphological and genetic character of wild populations in North America supports a single origin of introduction to that continent." Unlike the situation in *Cucurbita melopepo* (see below) of the USA, there appears to be little introgression from cultivars of *Cucumis melo* into the wild populations of var. *texanus*.

Plants identified as *Cucumis melo* var. *dudaim*, a modern and independent introduction to North America, are encountered outside of cultivation in Arizona and California along waterways and irrigation canals, fields, and roadsides.

Decker-Walters et al. (2002) compared wild North American populations (var. *texanus*) of *Cucumis melo* with a range of samples of var. *dudaim*, var. *chito*, small-fruited Old World populations, and a small set of other varieties and recorded detailed measurements of morphological

features of vars. *texanus*, *dudaim*, and *chito*. The key below draws from their observations; measurements are given as an approximate average ± one standard deviation

1. Plants monoecious, fruit 40 ± 5 mm wide, 49 ± 11 mm long, rind yellow, striped; flesh bitter, seeds 4 6 ± 0 4 mm long, hypanthial hairs 0 8 ± 0 1 mm long ..... *Cucumis melo* var. *texanus*
1. Plants andromonoecious, fruit 61 ± 9 mm wide, 67 ± 17 mm long, rind yellow or orange to red, striped, streaked, or speckled; flesh commonly sweet, seeds 7 2 ± 0 7 mm long; hypanthial hairs 1.7 ± 0 4 mm long

2. Rind with red to orange or brown stripes on a yellow to orange background ..... *Cucumis melo* var. *dudaim*
2. Rind usually with stripes, but sometimes streaked or speckled, on a yellow background ..... *Cucumis melo* var. *chito*

Decker-Walters et al. also noted that "Overall, plant parts of NA populations [var. *texanus*] were generally smaller than those of Chito and Dudaim cultivars. Where size differences existed between Chito and Dudaim, the Dudaim plant parts were usually larger. Interestingly, flowers of NA populations are in the upper-normal size range typical for *C. melo*, whereas Dudaim flowers are relatively large for the species." And "although ripe fruits of the cultivars always have a sweet external aroma, those of NA populations vary from scentless to sweet." Stepansky et al. (1999) found variability in sexuality in var. *dudaim* and var. *chito* — most were andromonoecious but with some accessions of both apparently monoecious.

Commonly recognized infraspecific taxa/cultivar groups of *Cucumis melo*.

Wide extremes of variation and horticultural selections exist within *Cucumis melo*, especially as based on fruit characters (e.g., size, shape, surface features, color, texture, taste, composition). The species includes feral, wild, and cultivated forms, including "dessert" melons, as well as non-sweet forms that are consumed raw, pickled, or cooked. This has led to a proliferation of names for the variants, and various systems of infraspecific classification have been proposed.

A widely used system proposed by Naudin (1859), dividing *Cucumis melo* into a single wild variety — *C. melo* var. *agrestis*, and six cultivated ones, *cantalupensis, inodorus, conomon, dudaim, flexuosus* and *momordica* — has been variously modified and simplified (e.g., Munger and Robinson 1991) as well as extended into a detailed hierarchical system (Grebenscikov 1953; see comments by Hammer et al. 1986). An excellent overview of infraspecific nomenclature in *C. melo* was provided by Pitrat et al. (2000; largely repeated by Burger et al. 2010 but "adapted to the International Code of Nomenclature for Cultivated Plants"), who proposed a similar alternative, with 5 cultivar groups in subsp. *agrestis*, 11 cultivar groups in subsp. *melo*, but molecular data have not supported their apportionment of the groups among the two subspecies. Many of these names may be encountered for plants potentially found outside of cultivation, and a simplified system more similar to the earlier ones is summarized here, followed below by formal nomenclatural summaries.

SUBSPECIES MELO.

a. *Cucumis melo* var. *melo*. Formally includes the more commonly recognized var. *cantalupo*.

a. *Cucumis melo* var. *cantalupo*. Asia, Africa; fruits aromatic, large to medium-large, round slightly ovoid or depressed-globose, moderately to strongly ribbed, rind smooth or warty, whitish to yellow, orange, greenish, or nearly black, flesh orange or green, sweet, dessert melons; usually andromonoecious. Examples: Charentais, Prescott Fond Blanc.

b. *Cucumis melo* var. *reticulatus*. Europe, western Asia, North America, South America, Japan; fruits aromatic, large to medium-large, round to slightly ovoid, ribbed or unribbed, rind reticulate to finely netted, variable in colour, flesh orange or green, sweet, dessert melons; andromonoecious. Pitrat et al.

(2000) equated var. *reticulatus* with cultivars "mainly developed this century in the U.S.A." (as in the brief description above and as cited in cultivar names following) but the neotype or lectotype presumably would be chosen from among heirloom races in cultivation in Europe before 1828 (see comments below). In the original description by Seringe, "Melon des Carmes" was noted as an example and the currently available Noir des Carmes apparently is similar. Examples of USA cultivars: Rocky Ford, Top Mark, Netted Gem, Bender, Hearts of Gold, Hales Best.

c. *Cucumis melo* var. *modorus*. Asia, Spain; fruits non-aromatic, large, round to ellipsoid, non-climacteric and long-storing, rind thick, smooth, wrinkled, or warty, white to yellow or green, flesh white, dessert melons; usually andromonoecious. Examples: honeydew, winter melon, muskmelon, casaba.

d. *Cucumis melo* var. *flexuosus*. Middle East, Asia, northern Africa; fruits very elongated, rind light green to green-striped, ribbed or wrinkled, flesh white, non-sweet, eaten immature as cucumbers or pickled; usually monoecious. Examples: snake cucumber, snake melon, cucumber melon, Armenian cucumber.

SUBSPECIES AGRESTIS.

e. *Cucumis melo* var. *agrestis*. Africa and Asia as free-living forms; fruits very small (less than 5 cm), inedible with very thin mesocarp and small seeds; monoecious.

f. *Cucumis melo* var. *chito*. Asia, or reportedly of American feral origin; fruits aromatic, small, plum-size, rind yellow, flesh white, used as pickles; monoecious. Combined with var. *dudaim* by some (e.g., Munger & Robinson 1991; Robinson & Decker-Walters 1997) but found to be distinct by Pitrat et al. (2000), Decker-Walters (2002), and others. "This type seems to occur mainly in Central America as a feral and is not really cultivated. It was probably introduced by African slaves to that region" (Pitrat et al. 2000, p. 35). Examples: mango melon, vine peach, glass melon.

g. *Cucumis melo* var. *conomon*. Eastern Asia cultivars; fruits smooth, white-fleshed, with thin rinds and often eaten as pickles; andromonoecious. Sometimes said to include var. *acidulus* Naud., which has orange rind. Examples: oriental pickling melon, Freeman's cucumber, Shiro-Uri.

h. *Cucumis melo* var. *texanus*. North America as free-living populations; fruits usually not aromatic, small, rind smooth, yellow, flesh white, bitter; monoecious.

i. *Cucumis melo* var. *dudaim*. Persia, grown as ornamental (for the aroma), sometimes for edible fruits; fruits aromatic, small, red to orange or brown striped; andromonoecious. Examples: dudaim melon, Queen Anne's pocket melon, smellmelon, pomegranate melon, plum granny.

j. *Cucumis melo* var. *chate*. Northern Africa, western and central Asia; fruits medium-size, round to elongate, ribbed, light to dark green, flesh white to light orange, eaten raw or pickled; monoecious or sometimes andromonoecious. Example: Carosello.

k. *Cucumis melo* var. *momordica*. India; fruits not aromatic, large, non-sweet, with thin rind splitting at maturity, flesh mealy-white, bland; monoecious. Examples: Indian snapmelon, phoot.

Formal nomenclature for commonly recognized infraspecific taxa of *Cucumis melo*.

Nomenclatural summaries are provided here for a selection of the most generally used names relating to the *Cucumis melo* complex. Details of nomenclature for other names, which number more than 500, can be found in Kirkbride's monograph (1993).

CUCUMIS MELO L., Sp. Pl. 2: 1011. 1753. Protologue: "CUCUMIS foliorum angulis rotundatis, pomis torulosis. Hort. cliff. 451. Hort. ups. 292. Mat. med. 444. Roy. Lugdb. 263. Melo vulgaris. Bauh. pin. 310. Melo. Bauh. hist. 2. p. 242. Habitat - - - - O." **LECTOTYPE** (Meeuse 1962, p. 61; see comments in Kirkbride 1993, p. 81): "HU 4," without data, cultivated at Uppsala, Herb. LINN 1152.8 (LINN digital image!).

The lectotype has no fruit but the expression of *Cucumis melo* that Linnaeus had in mind can be inferred. Bauhin and Cherler's Historia Plantarum Universalis (vol. 2, 1651), cited by Linnaeus in the protologue, illustrates a plant (p. 242; shown here in Fig. 6) with similar fruits. The accompanying description refers to fruits that are 'torose' (apparently the "torulose" = warty condition described by Linnaeus), channeled, reticulate, and green-colored. Entries in Hortus Cliffortianus (1737) and van Royen's Florae Leydensis (1740) both refer to Robert Morison's Plantarum Historiae Universalis (1680, Vol. 2), which includes a drawing (tab. 6, fig. 4; shown here in Fig. 7). The illustrated fruits are channeled and show what appears to be a shallowly warty rind. They are very similar to fruits of plants later described by Seringe as *Cucumis melo* var. *cantalupo* (see notes above and below), especially modern domesticates such as Charentais and Noir des Carmes.

a. SUBSPECIES MELO

Cucumis melo var. *flexuosus* (L.) Naud., Ann. Sci. Nat., Bot., ser. 4, 11: 63. 1859. *Cucumis flexuosus* L., Sp. Pl., ed. 2. 1437. 1763. *Melo flexuosus* (L.) Pangalo, Bot. Zhurn. (Moscow & Leningrad) 35: 577. 1950. *Cucumis melo* subsp. *flexuosus* (L.) Grebens., Kulturpfl. 1: 135. 1953. *Cucumis melo* convar. *flexuosus* (L.) Grebens., Kulturpfl., Beiheft 2 [Verzeichnis], 426. 1959. **LECTOTYPE** (Kirkbride 1993, p. 104): "Habitat in India," without data, Bauhin & Cherler, Hist. Pl. Univ. 2: 248 [icon]. 1651.

Cucumis melo var. *cantalupo* Ser. in DC., Prodr. 3: 300. 1828. *Cucumis cantalupo* Haberle ex Reichenb., Fl. Germ. Excurs., 295. 1831. *Cucumis cantalupensis* Haberle ex M. Roem., Fam. Nat. Syn. Monogr. 2: 69. 1846 ["*C. cantalupo* Rchb." and "*C. melo* ß *cantalupo* Ser." cited in synonymy]. *Cucumis melo* var. *cantalupensis* Naud., Ann. Sci. Nat., Bot., ser. 4, 11: 47. 1859 [*Cucumis cantalupensis* Haberle ex M. Roem. cited in synonymy]. *Cucumis eumelo* Pangalo subsp. *cantalupo* (Ser.) Pangalo, Bot. Zhurn. (Moscow & Leningrad) 35: 576. 1950. *Cucumis melo* convar. *cantalupo* (Ser.) Grebens., Kulturpfl. 1: 135. 1953. **TYPE**: Apparently not designated. No specimen was cited in the Prodromus entry by Seringe. "Fructu magno late costato verrucoso." "Cantaloup orange" (fructo parvo) and three cultivars (including two kinds of 'Prescott') with depressed fruits were included among examples.

None of the nomenclatural proposals listed above cited a specimen, but all probably referred to the same entity and it seems likely that all of them past 1828 had Seringe's description in mind. *Cucumis cantalupo* Haberle ex Reichenb. of 1831 (without an attribution to Seringe) preceded *C. cantalupensis* Haberle ex M. Roem. of 1846, which was superfluous. At varietal rank within *C. melo*, Naudin's proposal of 1859 was superfluous.

Cucumis melo var. *reticulatus* Ser. in DC., Prodr. 3: 300. 1828. **TYPE**: Apparently not designated. No specimen was cited in the Prodromus entry by Seringe. "Fructu rotundato vel oblongo, cortice reticulato griseo." Fruits were described as large to medium in size, and "M.[elon] des Carmes" was included among examples.

Var. *reticulatus* is probably correctly considered a formal synonym of *Cucumis melo* sensu stricto (var. *melo*).

Cucumis melo var. *inodorus* Naud., Ann. Sci. Nat., Bot., ser. 4, 11: 56. 1859. **TYPE**: Apparently not designated; no specimen cited by Naudin (or Jacquin).

An earlier proposal by Jacquin (*Cucumis melo inodorus* Jacq., Monogr. melon, 173. 1832) provided an infraspecific name for a "group" of melons composed of several "varieties," thus the epithet was proposed without a rank and the valid varietal name was only later established by Naudin. Protologue of Jacquin: "Nous avons cru devoir donner à ce groupe le nom de melons inodores, parce que toutes les variétés qui le composent sont absolument dépourvues d'arome; excepté quelques-unes qui, plus anciennement cultivées sous de limate de l'Europe, exhalent une légère odoeur, mais qui est, ainsi que nous l'avons dit, une modification résultant de notre temperature et des procédés que nous employons pour les cultiver." A later listing of *Cucumis melo* var. *inodorus* by C.O. Harz (Landw. Samenk. 2: 783. 1885) was superfluous if it indeed was intended as a new nomenclatural proposal.

b. SUBSPECIES AGRESTIS (Naud.) Pangalo

Cucumis melo var. *agrestis* Naud., Ann. Sci. Nat. Bot., sér. 4, 11: 73. 1859. *Cucumis melo* subsp. *agrestis* (Naud.) Pangalo, *Cucurbitacées*, in Zhukovsky, La Turquie Agricole [Zemledelich. Turtsiya], 534. 1933. *Melo agrestis* (Naud.) Pangalo, Bot. Zhurn. (Moscow & Leningrad) 35: 580. 1950. *Cucumis agrestis* (Naud.) Grebens., Kulturpfl. 1: 134. 1953. *Cucumis melo* forma *agrestis* (Naud.) de Wilde & Duyfjes, Sandakania 17: 55. 2008. **LECTOTYPE** (Kirkbride 1993): cultivated at Paris from seeds from India, *C. Naudin s.n.* (P; isolectotype: P).

Cucumis melo var. *dudaim* (L.) Naud., Ann. Sci. Nat. Bot., sér. 4, 11: 69. 1859. *Cucumis dudaim* L., Sp. Pl. 2: 1011. 1753. *Cucumis melo* subsp. *dudaim* (L.) Grebens., Kulturpfl. 1: 134. 1953. *Melo dudaim* (L.) Sageret, Ann. Sci. Nat. 8: 313. 1826. **LECTOTYPE** (Jeffrey 1980c, p. 20): Dillenius, Hort. Eltham. 2: 223, t. 177, f. 218. 1732. "Semina Marocco primum delata dicuntur. … P. Collinsòn, a Nobil. Dn. Petre mislum fructum & semina communicavit."

Cucumis melo var. *chate* (Hasselq.) Sageret, Mém. Agric. Soc. Roy. Centr. Agric. 58: 488. 1825. *Cucumis chate* Hasselq., Iter Palaest., 491. 1757. *Cucumis melo* subsp. *chate* (Hasselq.) Hassib, Cucurbit. Egypt 133. 1938. **NEOTYPE**: (Jeffrey 1980c, fide Kirkbride 1993): Plant cultivated at Uppsala, Sweden, presumably from Egypt. Herb. LINN 1152.11, digital image!). Kirbride (1993) noted that Jeffrey cited the Species Plantarum number (1152/5) rather than the LINN number (1152.11). The protologue: "Terra praegnans post inundationem Nili circa Cairum, nec in ullo alio loco universi Ægypti colitur, neque aliud sert solum."

Cucumis pictus Jacq., Hort. Vindob. 3: 17, t. 27. 1776. **LECTOTYPE** (Kirkbride 1993, p. 115): Hort. Vindob. 3: t. 27. 1776. Cultivated from seeds from India. Protologue: "Ex India orientali semina adlata suerunt. Per tres annos in horto perstitit. Quarto anno frucus maturos non dedit. Ex dissecto fructu guttae gummosae sudant." A synonym of *Cucumis melo* var. *dudaim*, fide Grebenscikov (1959).

Cucumis melo var. *conomon* (Thunb.) Makino, Bot. Mag. Tokyo 16: 16. 1902. *Cucumis conomon* Thunb., Nov. Acta Soc. Sci. Upsal. 3: 208. 1780 [Fl. Jap., 324. 1784]. *Melo conomon* (Thunb.) Pangalo, Bot. Zhurn. (Moscow & Leningrad) 35: 580. 1950. *Cucumis melo* convar. *conomon* (Thunb.) Grebens., Kulturpfl. 1: 135. 1953. *Cucumis melo* subsp. *conomon* (Thunb.) Grebens., Kulturpfl. 1: 135. 1953. **TYPE**: Japan. "Rwa, Furi uri, Sjiro uri, Tske uri et Tsuke uri, item communissime Konomon. Kaempf. Am. exot. Fasc. V. p. 811" (as in Fl. Japon., p. 324) (UPS-THUNBERG fiche 22794!).

Cucumis pubescens Willd., Sp. Pl. 4: 614. 1805. **TYPE**: Cultivated at Berlin, *C.L. Willdenow s.n.* (holotype: B-W, fiche 18048!). Provenance unknown, as explicitly indicated by Willdenow in the protologue; the sheet has "Hort. bot. Berol. W." A synonym of *Cucumis melo* var. *agrestis*, fide Grebenscikov (1953).

Cucumis melo var. *chito* (Morren) Naud., Ann. Sci. Nat., Bot., ser. 4. 11: 67. 1859. *Cucumis chito* Morren, Ann. Soc. Roy. Agric. Gand 5: 351, t. 278. 1849; J. Hort. Sci. Access. 5: 341. 1849. **LECTOTYPE** (Kirkbride 1993, p. 103): Ann. Soc. Roy. Agric. Gand 5: t. 278. 1849.

Cucumis melo var. *acidulus* Naud., Ann. Sci. Nat., Bot., ser. 4, 11: 66. 1859. **LECTOTYPE** (Kirkbride 1993, p. 104): Cultivated at the Muséum d'Histoire Naturelle, Paris, from seeds sent by Jules Lépeire from Pondicheri, India, 1858, *C.V. Naudin s.n.* (P; isolectotype: P).

Cucumis melo var. *momordica* (Roxb.) Duthie & Fuller, Field & Garden Crops 2: 50, t. 49. 1883. *Cucumis momordica* Roxb., Fl. Ind. 3: 720. 1832. **NEOTYPE** (Kirkbride 1993, p. 114): Roxburgh, Icones Roxburghianae, t. 456. 1964. India; described from cultivation from Tanjore country and southern parts of Karnatik.

Cucumis melo var. *texanus* Naud., Ann. Sci. Nat., Bot., sér. 4, 16: 160. 1862. **LECTOTYPE** (Kirkbride 1993, p. 113): Cultivated at the Muséum d'Histoire Naturelle, Paris, from seeds sent by Elias Durand from Philadelphia, 1861, *C.V. Naudin s.n.* (P; isolectotype: P).

The wild progenitor of *Cucumis sativus*?

Features and properties of the free-living *Cucumis hardwickii* Royle have been reported in numerous studies (e.g., Horst & Lower 1978; Puchalski et al. 1978; Kupper & Staub 1988; Bisht et al. 2004; Choudhary & Singh 2010). It is obviously closely related to *C. sativus* L., the two — alone in the genus — sharing the derived chromosome number of $2n = 14$, and *C. hardwickii* sometimes has been posited as the ancestor of *C. sativus* (see Sebastian et al. 2010). The geographic range of *C. hardwickii* is the northwestern Himalayas southward into the Eastern and Western Ghats and the central Plateau region of India.

In a series of reciprocal crosses among cucumber, muskmelon, and 19 wild species of *Cucumis*, Robinson and Kowalewski (1978) found that the only species that successfully crossed with *C. sativus* was *C. hardwickii* — producing fully fertile F_1s — and they regarded the two as conspecific entities (they suggested the rank of subspecies but did not make a formal nomenclatural proposal). Puchalski and Robinson (1990) and others also have treated the two taxa as conspecific varieties.

Among plants identified as *Cucumis hardwickii*, Bisht et al. (2004) found a high diversity for morphological as well as RAPD markers, and gene flow between *C. hardwickii* and *C. sativus* was indicated by the presence of segregating populations of apparent natural hybrids in several regions. Morphological variants have been recognized within var. *hardwickii* (Schuman et al. 1985; Staub & Kupper 1986).

Kirkbride (1993) and Jeffrey (1980b, 2001) observed that *Cucumis hardwickii* can be identified and recognized in its typical form but that morphological intergradation argues against its recognition as a distinct evolutionary entity with formal taxonomic recognition. Whitaker and Davis (1962) seconded earlier suggestions that *C. hardwickii* is an expression of some feral form of *C. sativus*, rather than an ancestor. A study by de Wilde and Duyfjes (2010) agreed that *C. hardwickii* is not sharply demarcated from feral forms of *C. sativus* and reduced its formal rank within *C. sativus* to forma.

On the other hand, *Cucumis hardwickii* is reported to be isozymically distinct from *C. sativus*. Knerr & Staub (1991) found that *C. hardwickii* possesses alleles for *Per-4* and *Idh* which were not present in the remainder of their samples of *C. sativus*. Meglic et al. (1996) also found that *C. hardwickii* is isozymically distinct from a large number of *C. sativus* samples.

Without consistent morphological differentiation between *Cucumis hardwickii* and the highly variable domesticated and feral forms of *C. sativus* sensu stricto, but with an apparent molecular distinction, their recognition at varietal rank seems appropriate. Rank of forma (as interpreted here) would imply that "hardwickii" is a populational variant. At least the relationship is not clearly one of progenitor-derivative.

CUCUMIS SATIVUS L., Sp. Pl. 2: 1012. 1753. **LECTOTYPE** (Ten Pas et al. 1985, p. 290): Herb. Burser vol. 17, no. 97 (UPS). From cultivation (as cited by de Wilde & Duyfjes 2007).

a. Cucumis sativus var. **sativus**

b. Cucumis sativus var. **hardwickii** (Royle) Gabaev, Cucumbers, 47. 1932. *Cucumis hardwickii* Royle, Ill. Bot. Himal. Mts. 1: 220; 2: t. 47. 1835. *Cucumis sativus* unranked *hardwickii* (Royle) Alef., Landw. Fl., 196. 1866. *Cucumis sativus* forma *hardwickii* (Royle) W.J. de Wilde & Duyfjes, Sandakania 17: 58. 2008. **TYPE** (as cited by de Wilde & Duyfjes 2007): India, *J.F. Royle s.n.* (LIV; isotype: K).

Another distinctive, formally named expression of *Cucumis sativus* has recently been recognized in the Bhutan flora (Grierson 1991): *C. sativus* var. *sikkimensis* Hook. f. Grierson distinguished it from the common cucumber by the following contrasts.

1. Leaves 3–5-lobed; ovary with 3 placentae; fruit greenish ..... var. *sativus*
1. Leaves 7–9-lobed; ovary with 5 placentae; fruit mottled yellow and brown ..... var. *sikkimensis*

Kirkbride (1993) placed var. *sikkimensis* in the synonymy of *Cucumis sativus*, but I have not encountered the name among samples evaluated in taxonomic studies of *C. sativus*. Presumably var. *sikkimensis* is derived from within the *C. sativus* lineage but this appears to be unconfirmed.

Comments by Hooker in the protologue are at least vaguely suggestive that he thought var. *sikkimensis* might be derived from *Cucumis hardwickii*. "The origin of the common Cucumber, which is supposed to be unknown, is in all probability the *C. Hardwickii*, Royle, of the Himalaya Mountains, which inhabits the sub-tropical region of the range from Kumaon to Sikkim. This opinion, founded on specimens gathered by myself in the latter country, is also adopted by M. Naudin, upon the same materials (Ann. Sc. Nat., l.c., p. 30). The flowers and leaves of the two plants are almost identical, but the fruit of *C. Hardwickii* is small, smooth, and very bitter; it is, however, striped with white and green, a very usual character with the Sikkim cultivated Cucumbers. ... [The Sikkim cucumber] is grown in all parts of the Sikkim and in the Nepal Himalaya, up to 5000 feet elevation, in prodigious quantities."

c. Cucumis sativus var. **sikkimensis** Hook. f., Bot. Mag. 102 (ser. 3, vol. 32): t. 6206. 1876. **TYPE**: **Sikkim**. Cultivated in the Tropical Economic House, Royal Botanic Gardens, Kew, s.n., from seed provided by Major Trevor Clarke, Aug 1875 (holotype: K; isotype: K). The mature fruit is beautifully illustrated by Walter Hood Fitch in the protologue. Nepalese cucumber, Sikkim cucumber, brown-netted cucumber, red-netted cucumber, Khiva cucumber

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3. CUCURBITA

In two instances in *Cucurbita*, progenitor-domesticate pairs have been treated as conspecific subspecies (Whitaker & Bemis 1975; Nee 1990; Merrick 1995; Sanjur et al. 2002). *Cucurbita andreana* Naudin, a wild species native to Argentina and Bolivia is identical in haplotype (no base pair differences) to the domesticated *C. maxima* and is recognized as *C. maxima* Duchesne subsp. *andreana* (Naudin) Filov. Similarly, the wild gourd *C. sororia* Bailey of Mexico and Central America is identical in haplotype to the domesticated *C. argyrosperma* Huber and is treated as *C. argyrosperma* subsp. *sororia* (Bailey) Merrick & Bates. Ecological, morphological, and isozymic evidence and crossing studies also support the close relationships of these paired taxa.

The domesticated species *Cucurbita ficifolia* Bouché and *C. moschata* Duchesne have unique haplotypes and no wild progenitor has been proposed for either. Mitochondrial DNA data combined with other information suggest that the wild ancestor of *C. moschata* will be found in lowland northern South America (Sanjur et al. 2002); Nee (1990) noted that the ancestor, from reports from Bolivia and Colombia, may be extant but undescribed. *Cucurbita ficifolia* has a preference for cool, high-elevation habitats and probably originated in South America (Nee 1990; Sanjur et al. 2002), from where the only reliable archaeological records of the species have come.

The situation involving *Cucurbita pepo* L. sensu lato is more complex. Archaeological, morphological, and molecular-genetic research indicate that more than a single lineage exists in the *C. pepo* complex. Subsp. *pepo* is distinct from the rest, which usually has been identified either as subsp. *ovifera* (e.g., Decker and Wilson 1986, 1987; Decker 1988; Decker-Walters et al. 1993) or as subsp. *ovifera* plus subsp. *fraterna* (e.g., Andres 1987; Lira-Saade et al. 1995). Isozyme data indicate that within the range of *C. pepo* sensu lato, "genetic divergence took place long before domestication and over an extensive period of time in at least four disjunct and ecologically distinct regions" (Decker-Walters et al. 1993).

1. Subsp. pepo, a Mexican lineage of domesticates, includes jack-o-lantern pumpkins, zucchini, marrow, cocozelle, and Mexican landraces. It differs from subsp. *ovifera* sensu lato by a derived molecular feature (a difference in three adjacent base pairs) that also occurs in *Cucurbita moschata* and the *C. sororia*/*C. argyrosperma* group (Sanjur et al. 2002). The wild ancestor of subsp. *pepo*,

which presumably shared this derived feature, has not been identified and may be extinct. Forms of subsp. *pepo* presumably were selected from ancestral populations in southern Mexico.

Data from mtDNA and RAPD studies (Sanjur et al. 2002; Decker-Walters et al. 2002) and earlier isozymic and cpDNA studies (e.g., Decker-Walters et al. 1993) also indicate that *Cucurbita pepo* subsp. *pepo* is distinct from the entities of subsp. *ovifera* sensu lato. The clade comprising subsp. *pepo* is basal to that of subsp. *ovifera* (Sanjur et al. 2002).

A landrace of *Cucurbita pepo* recently recognized by Teppner (2000, 2004) as *C. pepo* subsp. *gumala* Teppner, comprises a series of domesticates apparently authochthonous in Guatemala and adjacent southern Mexico, and they may be similar to the ancestral wild form. These have relatively small fruits (13–20 cm in diameter, depressed-globose) and extremely thick rind, ripening orange-yellow, and orange flesh. Teppner observed that the fruits of subsp. *gumala* are similar to ancient ones of *C. pepo* from Guilá Naquitz cave in Oaxaca (Smith 1997).

2. Subsp. ovifera sensu lato includes three, geographically separate wild forms, all of which have identical mitochondrial DNA sequences (Sanjur et al. 2002) as well as similarities in isozymes and other kinds of DNA (see comments following): var. *fraterna* of northeastern Mexico, var. *texana*, apparently confined to Texas, and the more recently described var. *ozarkana* of the east-central USA. No domesticates derived from var. *texana* have been identified, but various domesticates, mostly identified as var. *ovifera*, have been derived from within var. *ozarkana* — the scallop (pattypan), acorn, crookneck, and straightneck squashes, and a number of ornamental gourds (e.g., Crown of Thorns, Flat-Striped, Striped Pear, Bicolor Spoon, White Egg, Nest Egg, Miniature Ball, and most of those with deep orange color, Mandan, Orange Warted, Warty Hardhead). The ancestor of most of the domesticates is hypothesized to be var. *ozarkana*, because var. *texana* has a isozyme pattern not found in the other varieties (Decker-Walters et al. 1993; Decker-Walters et al. 2002).

The cultivars Orange Ball, Miniature Ball, and Orange Warted showed a close allozymic relationship with *Cucurbita pepo* sensu stricto in several earlier studies (e.g., Decker & Wilson 1987; Decker 1988), but the RAPD study of Decker-Walters et al. (2002) clusters only Orange Ball within *C. pepo* sensu stricto. Miniature Ball showed a high affinity for var. *fraterna* in morphological and allozymic analyses of Andres (1987) but the origin of Miniature Ball in the 2002 RAPD study is indicated to be from var. *ozarkana*. Similarly, White Egg clustered with var. *fraterna* in allozyme studies (Decker-Walters et al. 1993) but later with var. *ozarkana* (Decker-Walters et al. 2002).

Var. *fraterna* is endemic to Tamaulipas and Nuevo León, Mexico, where it grows in seasonably dry, upland thornscrub habitat. It also is reported to be common as a weed in agricultural fields (Lira et al. 2009). It was first described at specific rank (Bailey 1943) and subsequently included within *C. pepo* at either varietal or subspecific rank (see below). Var. *fraterna* appears to be discrete both morphologically and geographically and it has a coordinate (sister) position relative to the two USA entities of subsp. *ovifera* in the cluster diagrams of Decker-Walters et al. (1993) and Decker-Walters et al. (2002).

Isozyme and RAPD data indicate that var. *texana* sensu stricto is limited to south-central Texas (Decker-Walters et al. 1993, 2002), mostly in drainage systems of the Brazos, Colorado, Guadalupe, Nueces, San Antonio, and Trinity rivers (Cowan & Smith 1993). Its habitats — creek and river banks, lake shores, marsh banks, low woods, dunes, and disturbed sandy sites — are distinct from the drier ones of var. *fraterna*. Habitats recorded for var. *ozarkana* are generally similar to those of var. *texana*, except perhaps tending to be more ruderal — creek and river banks, gravel bars, bottomland forests, soybean, corn, and cotton fields, old fields, fencerows, railroad ROWs, roadsides, and disturbed sites. Var. *ozarkana* occurs in the central Mississippi Valley and the Ozark Plateau.

Populations in Alabama were included in var. *ozarkana* by Cowan and Smith (1993) but their evolutionary status was considered "uncertain" by Decker-Walters et al. (1993); the Alabama plants do not share the specialized isozyme pattern of var. *texana* but otherwise do not closely cluster with samples of var. *ozarkana*.

Wild populations of subsp. *ovifera* (not further identified to variety) were distributed in the early Pleistocene as far southeast as Florida (Newsom et al. 1993). Some weedy-habitat populations of var. *ovifera* extant in Illinois and Kentucky may have evolved as cultivar escapes (e.g., Wilson 1990), and some of these may also have experienced subsequent introgression with other nearby cultivated, weedy, or wild populations of var. *ozarkana* (Kirkpatrick & Wilson 1988; Decker-Walters et al. 2002 and included references).

Molecular differentiation between var. *texana* and var. *ozarkana* suggests that they have been reproductively isolated for a long period, but Teppner (2004) considered morphological variability as too overlapping to allow their unarbitrary separation. Molecular data reliably separate them and clearly delimit var. *fraterna* as well, but morphology needs to restudied in detail. Fruits of var. *ozarkana* usually are ivory-white at maturity vs. green-and-white striped in var. *texana*, but this is not completely consistent (Andres 1995; pers. observ.). Fruits of var. *fraterna* are green-and-white striped, turning yellow-orange at maturity.

Taxonomic rank.

Entities generally treated as *Cucurbita pepo* sensu lato are here apportioned between two species: *C. pepo* L. (known only from domesticated forms) and *C. melopepo* L. (known from wild forms and domesticates), emphasing their geographic and molecular differences. *Cucurbita melopepo* (1753) predates *C. ovifera* L. (1766) when that entity is treated at specific rank and is regarded here to include var. *fraterna*, var. *texana*, var. *ozarkana* (the wild forms) and var. *melopepo* (the domesticated forms). The wild forms of *C. melopepo* are geographically and molecularly distinct, but they cluster closely among themselves and form an evolutionary lineage separate from *C. pepo*. It seems likely that the three wild taxa of *C. melopepo* represent geographic segregates (vicariants) of a widespread ancestor, and perhaps *C. pepo* sensu stricto evidences an even earlier vicariant divergence from an ancestor of the entire complex.

For consistency within *Cucurbita* and other genera where wild progenitor/domesticate pairs are identified at subspecific rank, the var. *melopepo* domesticates are recognized as subsp. *melopepo*, coordinate with the three wild varieties, which are treated as *C. melopepo* subsp. *texana*. As currently understood, the domesticates are derived only from var. *ozarkana*, but it is not known whether they had a single common ancestor (populationally) or whether some of them have been independently derived. The possibility also remains that several of the domesticates are derived from var. *fraterna*.

The wild ancestor of *Cucurbita pepo* has not been identified but perhaps will prove to be subsp. *gumala* or some other uninvestigated landrace of southern Mexico.

CUCURBITA PEPO L., Sp. Pl. 2: 1010. 1753. *Cucumis pepo* (L.) Dumort., Fl. Belg., 54. 1827. **LECTOTYPE** (Keraudren-Aymonin in Aubréville & Leroy (eds.), Fl. Cambodge Laos Viêt-Nam 15: 105. 1975): Locality not indicated, Herb. Linn. No. 1151.4 (LINN).

"*Cucurbita pepo*, with Herb. Burser XVII: 103 (UPS) as type, was proposed as conserved type of the genus by Jarvis (in Taxon 41: 562. 1992). However, the proposal was eventually ruled unnecessary by the General Committee (see Barrie, *l.c.* 55: 795-796. 2006 for a review of the history of this and related proposals). [quotation continues]

Bailey (in Gentes Herb. 2: 79. 1929) reproduced the protologue and various of the original elements (including a Dalechamp figure and a LINN sheet) and provided an

extensive discussion. Keraudren-Aymonin's (1975) type choice of 1151.4 (LINN) has priority over that of the Burser material designated by Jeffrey (in Jarvis, *l.c.* 41: 562. 1992) and becomes the type with the failure of the conservation proposal" (two paragraphs above quoted from the online database of The Linnaean Plant Name Typification Project — accessed January 2011).

A. SUBSPECIES PEPO

Cucurbita aurantia Willd., Sp. Pl. 4: 607. 1805. *Cucurbita pepo* var. *aurantia* (Willd.) C. Harz, Landw. Samenk. 2: 818. 1885. **TYPE**: Not designated. Locality not indicated in the protologue: "Fructus magnitudine facie et colore simillimus Citro Aurantio. W." **Type material**: B-Willdenow fiche 18031; the sheet says "Bouché W." Similar to the Orange Ball cultivar.

Cucurbita pepo var. *medullosa* Alef., Landw. Fl., 218. 1866. **TYPE**: Not designated. Protologue: "Frucht kleiner und etwas weicher als bei der Vorigen, oboid-oblong, regelmässig, dadurch der folgenden Gruppe ähnlich. — In England un Nordamerika sehr beliebt, wie Gurken zubereitet, also vor der Reife." Generally cited at varietal rank, but Alefeld described it without rank within his "Var.-Gr. 1" and it is perhaps better interpreted at "subvar." rank. Explicitly identified by Alefeld as "Vegetable marrow."

B. SUBSPECIES GUMALA

Cucurbita pepo subsp. **gumala** Teppner, Phyton (Horn) 40: 34, figs. 3, 24, 25. 2000. **TYPE**: **Guatemala**. Cultivated in the Botanical Garden of the Institutes for Botany, Universität Graz, Austria, 8 Aug 1989, *H. Teppner s.n.*, from seeds from Guatemala sent by Scheidt (Gießen, Germany) in Sep 1988 (holotype: GZU; isotype: GZU).

CUCURBITA MELOPEPO L., Sp. Pl. 2: 1010. 1753. *Cucurbita polymorpha* var. *melopepo* (L.) Duchesne ex Lam., Encycl. 2: 157. 1786. *Cucurbita pepo* var. *melopepo* (L.) Alef., Landw. Fl., 220. 1866. **LECTOTYPE** (designated here): The illustration in Bauhin's Historia (J. Bauhin and J.H. Cherler, Historia plantarum universalis 2: 224. 1651), reproduced here as Fig. 8. Locality not indicated in the protologue: "Cucurbita foliis lobatis, caule erecto, pomis depresso-nodosis. Melopepo clypeiformis. Bauh. pin. 312. Cucurbita clypeiformis f. Siciliana. Bauh. hist. 2. p. 224. Habitat - - - - ʘ. Cirrhi sunt in caule, quamvis non scandat, nec procumbat."

Comments of Bailey (1929, p. 84): "This plant according to Linnaeus, is erect, not climbing or procumbent although he states that it bears tendrils; the leaves are lobed, the fruit depressed or flattened endwise and knotty. It is the 'Melopepo clypeiformis' of Caspar Bauhin's Pinax and 'Cucurbita clypeiformis' of Johann Bauhin's Historia; the latter has a picture, which is reproduced in Fig. 40; clypeiformis means shield-shaped or buckler-shaped; the plant is undoubtedly what we know as Bush Scallop squash. ... In the herbarium of Linnaeus there is no specimen of *C. melopepo* named by him." In the entry for *Cucurbita melopepo* in "Order Out of Chaos," Jarvis (2007) noted "Type not designated."

A. SUBSPECIES MELOPEPO

a. Cucurbita melopepo L. var. **melopepo**

Cucurbita verrucosa L., Sp. Pl. 2: 1010. 1753. *Pepo verrucosus* (L.) Moench, Method. Pl. 2: 653. 1794. *Cucurbita pepo* var. *verrucosa* (L.) Béguinot, Fl. Italia 3: 163. 1903. **TYPE**: Not designated. Locality not indicated in the protologue: "Cucurbita foliis lobatis, pomis nodoso-verrucosis. Cucurbita verrucosa Bauh. hist. 2. p. 222. Melopepo verrucosus. Tournef. inst. 106." Fruits subglobose and verrucose, apparently similar to the Orange Warted cultivar.

Cucurbita ovifera L., Syst. Natur. (ed. 12) 2: 639. 1766; Mant. Pl. 1: 126. 1767. *Cucurbita pepo* subsp. *ovifera* (L.) Decker, Econ. Bot. 42: 11. 1988. *Cucurbita pepo* var. *ovifera* (L.) Alef., Landw. Fl., 224. 1866. *Cucurbita pepo* var. *ovifera* (L.) C. Harz, Landw. Samenk. 2: 819. 1885. **LECTOTYPE** (Bailey 1929, p. 88, Fig. 41): **Russia**. Province of Astrakhan. "Habitat ad Astrachan. DD. Lerche." Sent by J.J. Lerche from Astrakhan, grown by Linnaeus at the Uppsala Botanical Garden, Herb. Linn. No. 1151.2 (LINN).

"The first validly named ornamental gourd was *C. ovifera* in 1767. The closest extant cultivar to Linnaeus's description and type specimen appears to be either the 'Striped Pear' or 'Egg' gourd. ... The full scientific name for the ornamental gourds today is practically always written *C. pepo* var. *ovifera* (L.) Alef. Yet Alefeld transferred the epithet to the rank of 'Var.-Gr.,' not to 'var.' The first traceable authority to validly publish the name *C. pepo* var. *ovifera* was Harz in 1885. Other varietal names for the ornamental gourds precede this, such as *C. pepo* var. *oviformis* Vilm. described in 1863, but the name ovifera has priority over all of these" (Andres 1995, pp. 67–68).

Subsp. *ovifera* is used in various places in the present discussion, reflecting the prevalent use of that name in recent literature, but within *Cucurbita pepo*, subsp. *texana* (Scheele) Filov (1982) has priority over subsp. *ovifera* (1988). Few publications have used the correct name (e.g., Paris et al. 2002).

Cucurbita lignosa Mill., Gard. Dict. (ed. 8), Cucurbita sp. no. 5. 1768. **TYPE**: Not designated. Locality not indicated in the protologue. "The fruit of the fifth sort hath a hard shell when ripe like the first, which may be dried and preserved many years: these are of very different forms and size; some are shaped like a Pear, and are no bigger than a large Catherine Pear; some are as large as quart bottles, and almost of the same form; others are round and shaped like an Orange, and are of the same size and colour, but these are very variable." Synonym of *C. pepo*, fide Andres (1995). If acquired by Miller from along the coast of east-central Mexico, it suggests that it might be derivative from *C. fraterna* or *C. pepo* sensu stricto.

Cucurbita subverrucosa Willd., Sp. Pl. 4: 609. 1805. *Cucurbita pepo* var. *subverrucosa* (Willd.) C. Harz, Landw. Samenk. 2: 819. 1885. **TYPE**: Not designated. Locality not indicated in the protologue. "Fructus clavato-ellipticus flavus palmaris verrucis paucis sparsis obsitus. Forte hybrida progenies a praecedente [*C. verrucosa* L.] orta, sed fructus longe diversus. W." **Type material**: B-Willdenow fiche 18037!; the sheet says "Hort. bot. Berol. W." Synonym of *Cucurbita pepo*, fide Andres (1995) and apparently *C. melopepo* var. *melopepo* as interpreted here.

Cucurbita pepo var. *condensa* L.H. Bailey, Cycl. Amer. Hort. 409. 1900. **LECTOTYPE** (designated here): Origin unknown, cultivated at Cornell University. Trade Name: Ea. White Scallop Squash Bush 41, Stock from: Thornburn, University Garden: 18 Sep 1890, *L.H. Bailey s.n.* (BH 33216 digital image!). The protologue noted only this: "Bush pumpkins. Scallop and Summer Crookneck squashes. Plant compact, little or not at all running. Of horticultural origin."

As noted in pencil on the sheets, 8 collections of *Cucurbita pepo* — most with a photo or drawing of the mature fruit — were in a BH folder labeled *C. pepo* var. *condensa*: 2 of "Green-Striped Bush, 2 of Scallop, 2 that approach Crown of Thorns, 1 of "Egg Plant Bush," and 1 of Pineapple (a variant of 'turban' morphology). All of these have labels with a printed heading of "Garden Herbarium of the Cornell University Experiment Station" and all were collected on September 17 and 18, 1890. Bailey did not cite a specimen and none of these is annotated as "var. *condensa*," but it seems clear enough that these can be considered original material. Bailey (1929) listed var. *condensa* as a synonym of *C. pepo* var. *melopepo*.

B. CUCURBITA MELOPEPO SUBSPECIES TEXANA (Scheele) G.L. Nesom, comb. nov. *Tristemon texanus* Scheele, Linnaea 21: 586. 1848.

a. Cucurbita melopepo L. var. **ozarkana** (Decker) G.L. Nesom, comb. nov. *Cucurbita pepo* var. *ozarkana* Decker-Walters, J. Ethnobiol. 13: 69. 1993. **TYPE: USA. Arkansas**. Independence Co.: 200 m downstream from Batesville, 100 m from edge of White River on first terrace, 6 Nov 1990, *B. Smith* & C.W. *Cowan* 115 (holotype: US digital image!).

b. Cucurbita melopepo L. var. **texana** (Scheele) G.L. Nesom, comb. nov. *Cucurbita pepo* var. *texana* (Scheele) Decker, Econ. Bot. 42: 12. 1988. *Cucurbita pepo* subsp. *texana* (Scheele) Filov, Fl. Cult. Pl. USSR 21: 177. 1982. *Cucurbita texana* (Scheele) A. Gray, Boston J. Nat. Hist. 6: 193. 1850. *Tristemon texanus* Scheele, Linnaea 21: 586. 1848. **TYPE: USA. Texas**. Comal Co.: Upper Guadeloupe [River], [margins of thickets,] in moist woods, Sep [1845], *F.J. Lindheimer Fasc. III. 4000* (holotype: B, presumably; possible isotypes: GH, MO-2 sheets digital images!). The protologue in Linnaea cites as collection data only this: "Niederliegend oder über niedrigem Gebüsch rankend an der Guadeloupe: Lindheimer. Juni." One of the MO sheets has a handwritten label noting the number "472" with a date of "Sept 1845," but the printed label has 1846. The other MO sheet (3265652) has a handwritten label noting the number "360" with a date of "Juni Juli 1846." It is not clear that any of the collections at GH and MO are duplicates of the type; those dated September presumably are not.

c. Cucurbita melopepo L. var. **fraterna** (L.H. Bailey) G.L. Nesom, comb. nov. *Cucurbita pepo* var. *fraterna* (L.H. Bailey) Filov, Fl. Cult. Pl. USSR 21: 177. 1982. *Cucurbita pepo* subsp. *fraterna* (L.H. Bailey) Lira, Andres, & Nee, Estud. Tax. Ecogeográf. Cucurbitaceae, 77. 1995. *Cucurbita fraterna* L.H. Bailey, Gentes Herb. 6: 288, Fig. 145. 1943. **TYPE: Mexico. Tamaulipas**. On Mesa de Llera, along roadside, herbaceous vine, corolla orange-yellow, Jul 1937, *C.L. Lundell 7289* (holotype: MICH digital image!; isotypes: MO, TEX!).

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I am grateful to Dr. Jochen Heinrichs, Curator of GOET, for information on authentic material of *Citrullus* studied by Schrader and loan of the Fischer specimens, to Tracy Wells and Craig Brough at the Kew Herbarium Library for providing the relevant page of the 1834 Goettingen seed catalogue (see *Citrullus caffer*), to Tom Wendt and the TEX staff for arranging the loan from GOET and for hospitality while studying at TEX, to Amber Schoneman at TEX for providing the images of *C. caffer*, to Roy Gereau and Peter Goldblatt at MO for information on African seed catalogs and place names, to Anna Stalter and Peter Fraissinet at BH for information and digital images of *Citrullus* specimens considered to be original material of L.H. Bailey, and to Nancy Elder, Life Sciences Librarian at the University of Texas, and Barney Lipscomb at BRIT for help with literature. I also am indebted to Jim Reveal for comments on choice of a type for *Cucurbita melopepo*, Tom Wendt for an interesting and helpful discussion on the typification of *Citrullus caffer*, and Kanchi Gandhi for critical observations toward the correct interpretations of authorship citations for names by Schrader in *Citrullus*. This study was done in conjunction with preparation of the FNANM treatment of Cucurbitaceae and supported in part by the Flora of North America Association.

Figure 1. Lectotype of *Citrullus caffra* Schrad. (GOET). See text.

Figure 2. Isolectotype of *Citrullus caffra* Schrad. (GOET). See text.

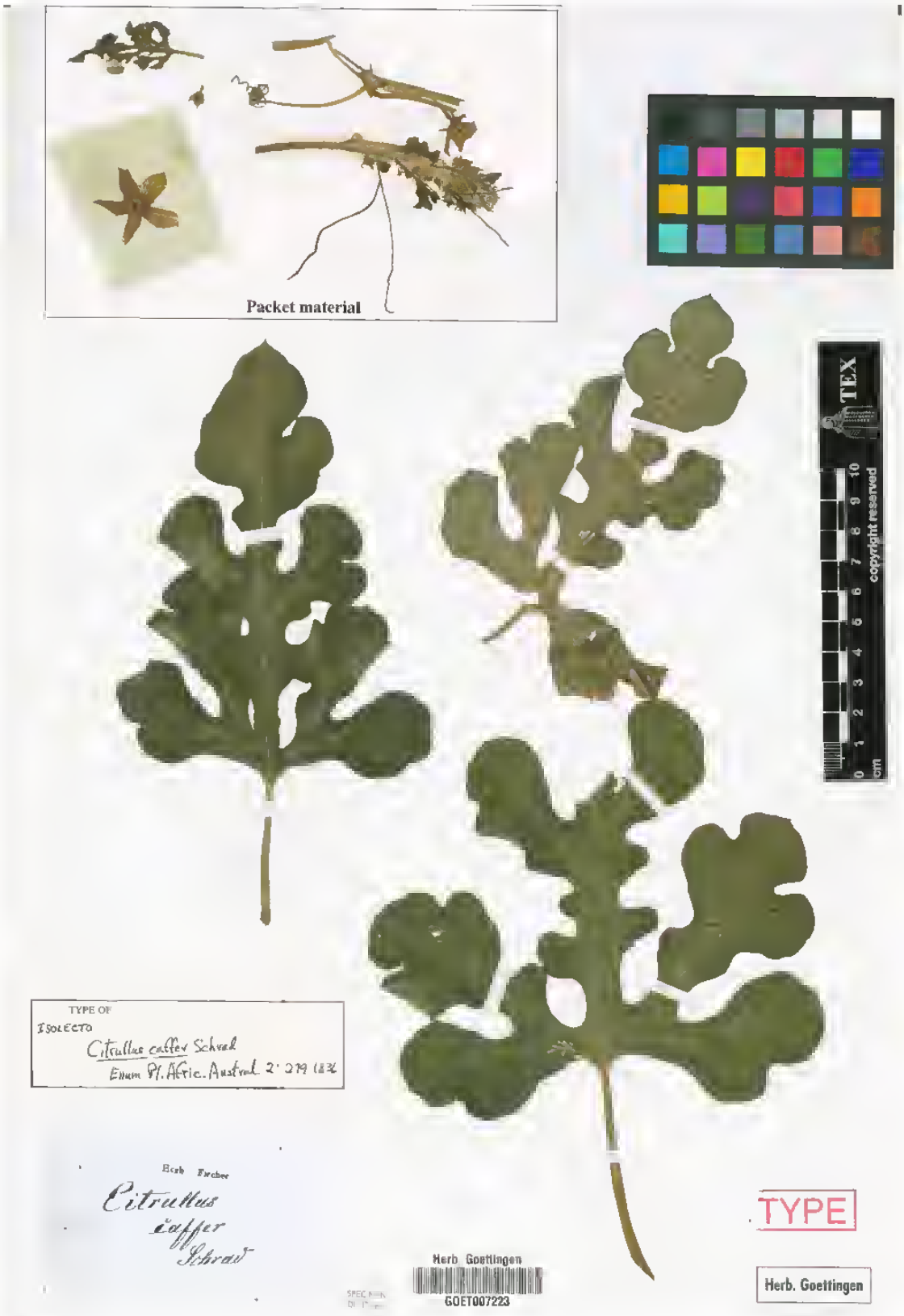

Figure 3. Isolectotype of *Citrullus caffra* Schrad (GOET). See text

Figure 4. Lectotype of *Citrullus vulgaris* var. *citroides* L. H. Bailey (BH). See text

Figure 5. "Mini seedless" triploid watermelon, *Citrullus lanatus*, at the end of its remarkable oddysey beginning from a small, fertile-diploid, bitter-flesh African ancestor. This one was grown in Mexico, according to its label.

Figure 6 "Melones" in Bauhin and Cherler's Historia Planta Universalis (1651, vol 2, p 242) The page with the illustration was cited by Linnaeus in the 1753 protologue of *Cucumis melo* Along with the protologue and lectotype, this illustration and the one from Morison's Plantarum Historiae Universalis (in Fig 5) provide a fuller morphological formulation of Linnaeus's concept of the species and of *C melo* var *melo* in the strict sense

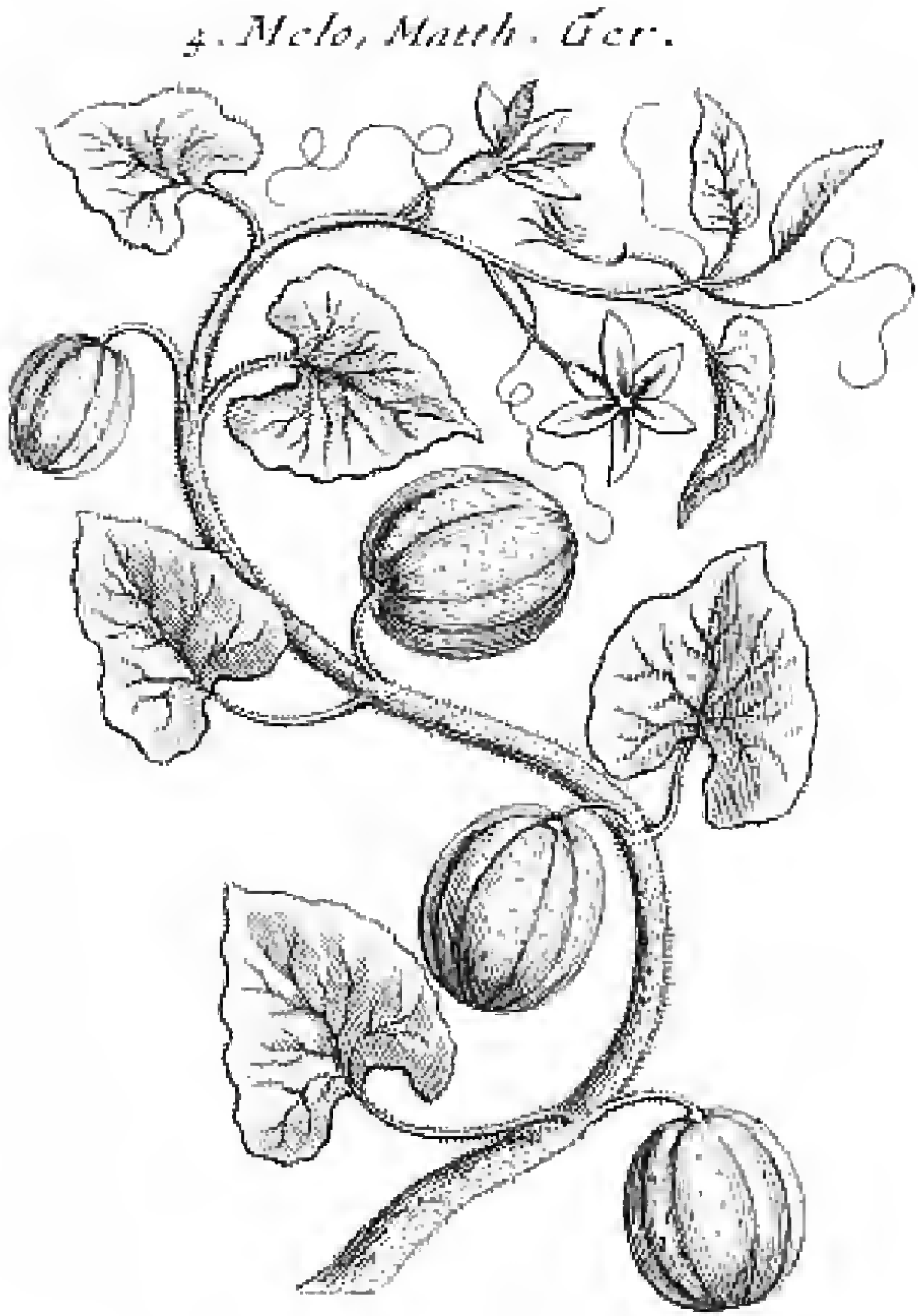

Figure 7. "Melo" in Robert Morison's Plantarum Historiae Universalis (1680, vol. 2, series 1, tab. 6, fig. 4). This illustration is referred to in Hortus Cliffortianus (Linnaeus 1737) and Florae Leydensis (van Royen 1740), both cited by Linnaeus in the 1753 protologue of *Cucumis melo*.

Figure 8 *Cucurbita clypeiformis* from Bauhin and Cheiler Historia plantarum universalis 2 224 1651 The page with this illustration was cited by Linnaeus in the protologue of *Cucurbita melopepo* L (1753) and the illustration is designated above as the lectotype of the species

Turner, B.L. 2011. Taxonomy of the papillose *Euphorbia* [Tithymalus] *longecornuta* complex (Euphorbiaceae) of northern Mexico. Phytoneuron 2011-14: 1–7. Mailed 7 March 2011

TAXONOMY OF THE PAPILLOSE *EUPHORBIA* [TITHYMALUS] *LONGECORNUTA* COMPLEX (EUPHORBIACEAE) OF NORTHERN MEXICO

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ABSTRACT

Euphorbia longecornuta is the earliest (first proposed in 1890) of four species in northern Mexico, all belonging to the Tithymalus group, which possess papillose leaves, stems, or cyathia. An additional two species (*E. ivanjohnstonii* and *E. pinkavana*) were subsequently proposed by M.C. Johnston, and a fourth (*E. creberrima*) by the late Rogers McVaugh. The taxonomy of the group is discussed and a key to the taxa presented. **Euphorbia ivanjohnstonii** forma **longifolia** B.L. Turner, forma nov., is proposed and a photograph of the holotype is provided, along with a map showing distributions of the taxa concerned.

KEY WORDS: Euphorbiaceae, *Euphorbia*, *Tithymalus*, Mexico, Coahuila

Identification of miscellaneous plants from northern Mexico has occasioned the present paper, which deals with the four known papillose taxa of northern Mexico (Fig. 1), all belonging to the Tithymalus group of *Euphorbia* sensu lato. Webster (1967), for example, regarded the group as *Euphorbia* subg. *Esula* sect. *Tithymalus*.

Key to *Euphorbia* species of northern Mexico having papillose vestiture

1. Middle and upper stem-leaves mostly 0.8–1.3 cm long.

   2. Involucral glands ca 1.0 mm wide; southern Nuevo León ..... **Euphorbia longecornuta**
   2. Involucral glands 0.5–0.8 mm wide; northeastern Coahuila ..... **Euphorbia ivanjohnstonii**

1. Middle and upper leaves 1.5–3.5 cm long.

   3. Stems glabrous; Sierra de la Madera, northwest of Cuatro Cienagas ..... **Euphorbia pinkavana**
   3. Stems papillose, like the leaves.

      4. Involucral glands ca 1.0 mm wide; Durango ..... **Euphorbia creberrima**
      4. Involucral glands 0.4–0.8 mm wide; northern Coahuila
         ..... **Euphorbia ivanjohnstonii** forma **longifolia**

1. EUPHORBIA CREBERRIMA McVaugh, Contr. Univ. Michigan Herb. 19: 218. 1993.

McVaugh treated this species in some detail, pointing out its relationship to *Euphorbia furcillata*, but noted that the "epidermal outgrowths in *E. creberrima* [which are lacking in *E. furcillata*] are almost incredibly like those of *Euphorbia ivanjohnstonii*." Indeed, in habit and foliage it most resembles the forma *longifolia*, as noted in the above key.

2. EUPHORBIA IVANJOHNSTONII M.C. Johnston, Wrightia 5: 129. 1975.
Tithymalus ivanjohnstonii (M.C. Johnston) Soják, Čas. Nár. Mus., Odd. PYír. 148: 199. 1979[1980].

Johnston (1975) provided an excellent account of this taxon, noting its occurrence in the Sierra del Pinos of northeastern Coahuila and its close relationship to *E. pinkavana*. He neglected, however, to associate the taxon with *E. longecornuta*, perhaps because, in proposing the species, Watson referred to the leaves as glabrous.

Euphorbia ivanjohnstonii forma **longifolia B.L. Turner, forma nova** Fig. 2
Euphorbiae ivanjohnstonii typicae similis sed differt habitu erectiore tenuiore et laminis foliorum longioribus (1.5–3.0 cm longis vs 0.5–1.5 mm).

TYPE: MEXICO. Coahuila. Mpio. Ocampo, ca 63 (air) miles S of the S-most Mex-US border of Big Bend, in Sierra Santa Fe del Pino, Canon del Pino (VACA), on NE facing limestone slope, ca 5 miles above the main ranch, in narrow canyon, 6000 ft, 28° 10' N, 103° 01' W, 12 Oct 1976, *J. Henrickson 15643* [with M. Dillon] (holotype: TEX).

The type specimen was originally identified by both its collector and myself as *Euphorbia ivanjohnstonii* (Fig. 3), which it resembles in vestiture and characters of the cyathia, but it is very different in habit and foliage, being a stiffly erect perennial with linear-oblanceolate leaves. My initial intuition led me to think it might be new, but considering the leaf variation found in related taxa and its occurrence in the Sierra del Pinos, which contains the only populations of *E. ivanjohnstonii*, I suspect it is but a leaf form, hence the above bestowal of rank.

Johnston (1975), in his description of *Euphorbia ivanjohnstonii*, compared his novelty with *E. brachycera* Engelm. Indeed the two taxa were found growing together at the type locality of forma *longifolia* (cf. *Henrickson 15644*, TEX, Fig. 4), but there is not a hint of papillosity in the latter and their flowers are markedly different. Furthermore, none of the numerous specimens of *E. brachcerya* (Fig. 5) on file at LL-TEX possesses a papillose vestiture, although a precious few collections from the trans-Pecos region of Texas (e.g., Presidio Co., Chinati Peak, ca 5200 ft.) produce a vestiture of very short hairs approaching that of *E. mcvaughiana* M.C. Johnston, but not truly papillate.

3. EUPHORBIA LONGECORNUTA S. Wats., Proc. Amer. Acad. Arts 18: 161. 1890.

This species is known to me by only two collections, the type (isotype TEX!) and a nearby collection from the Cima de la Sierra de la Marta at 3400 m (*Villarreal 8141*, TEX); the latter was annotated as *Euphorbia pinkavana* by Mark Mayfield in 1998, although he thought it might be a collection of *E. longecornuta* when originally examined (in 1995). Because of its locality, overall gestalt, and papillose stems it is almost certainly a collection of the latter. It differs somewhat from the latter in the shorter "horns" on the involucral glands (ca 0.5 mm long vs 1.0 mm long), but such horns are quite variable among the papillose taxa concerned.

Interestingly, Watson described the type of *Euphorbia longecornuta* as "glabrous and glaucus," no doubt because of a lack of modern optical resolution that readily reveals the minute papillosity found on its foliage and stems. To my knowledge, McVaugh (1993) was the first to point out its relationship to the other papillose taxa, this not mentioned by Johnston (1975) in his treatment of the Chihuahuan taxa.

Finally, it can be noted that *Euphorbia ivanjohnstonii* might be subsumed within the parameters of this taxon without much ado since they are very similar in habit, foliage, and vestiture, differing primarily in the size and shape of their involucral glands, as noted in the above key.

4. EUPHORBIA PINKAVANA M.C. Johnston, Wrightia 5: 126. 1975.
Tithymalus pinkavanus (M.C. Johnston) Soják, Čas. Nár. Mus., Odd. PYír. 148: 199. 1979[1980].

Johnston (1975) provided an excellent account of this taxon, noting its close relationship with *Euphorbia pinkavana*, but failing to call attention to its relationship with the equally close *E. longecornuta*, as noted in the above.

ACKNOWLEDGEMENTS

Guy Nesom provided the Latin diagnosis, for which I am grateful. He also read an early draft of the paper, providing helpful suggestions, as did my bosom colleague, Jana Kos. Distribution maps are based upon specimens on file at LL-TEX and those specimens cited in the papers of Johnston (1975) and McVaugh (1993).

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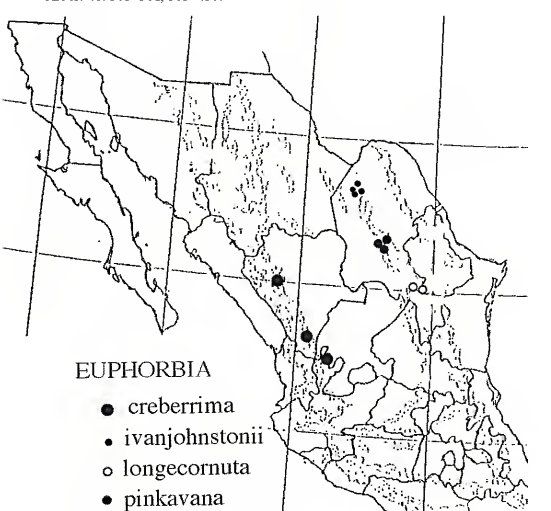

Figure 1. Distribution of papillose *Euphorbia* taxa in Mexico.

Figure 2. *Euphorbia ivanjohnstonii* forma *longifolia* (holotype: TEX).

Figure 3. *Euphorbia ivanjohnstonii* (typical form).

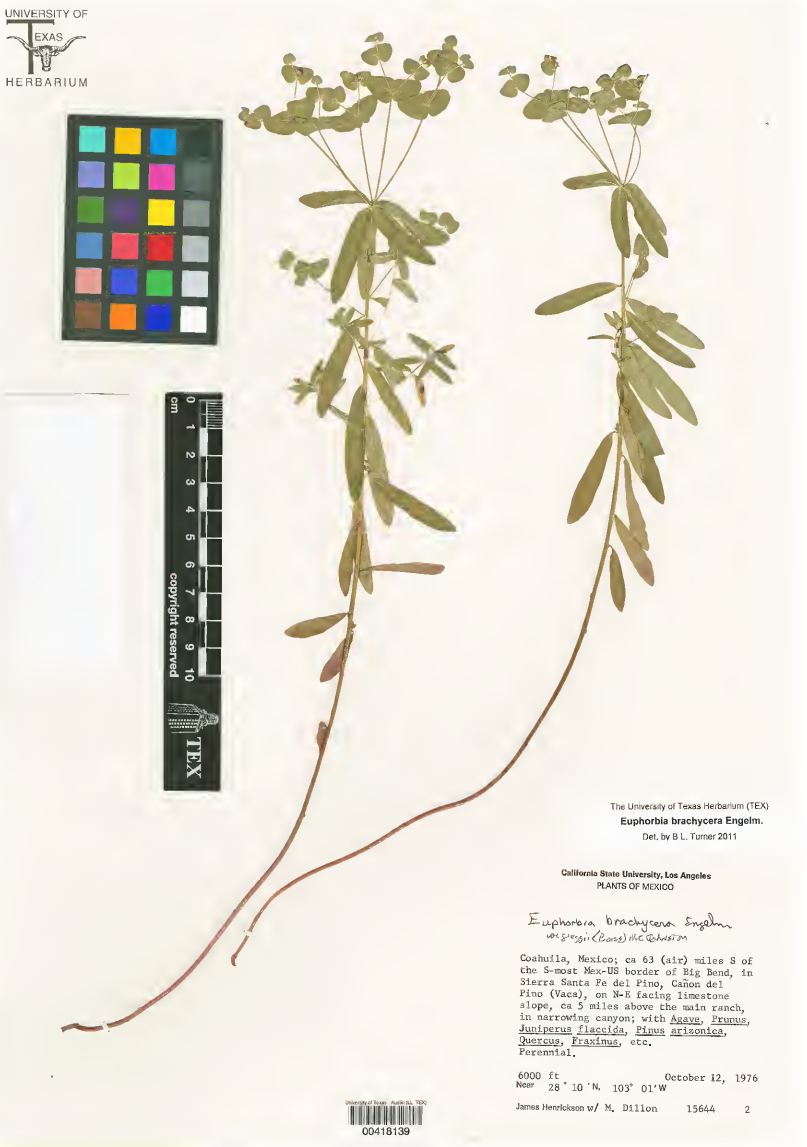

Figure 4. *Euphorbia brachycera* (growing with *E. ivanjohnstonnii* forma *longifolia*).

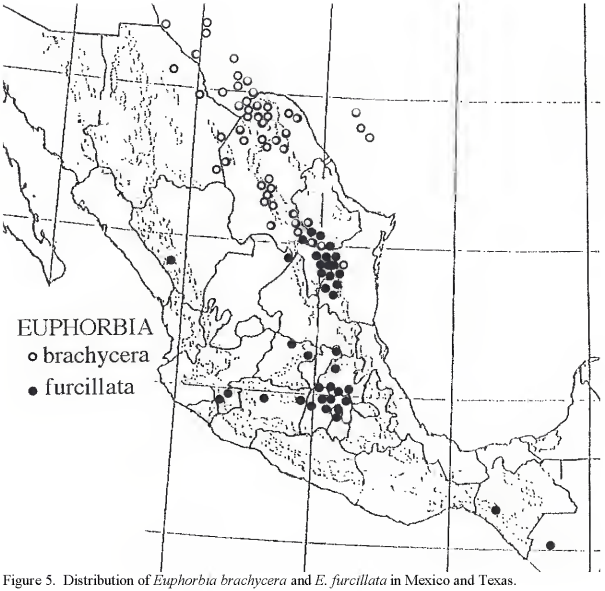

Figure 5. Distribution of *Euphorbia brachycera* and *E. furcillata* in Mexico and Texas.

TAXONOMY OF *SICYOS* (CUCURBITACEAE) IN THE USA

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ABSTRACT

Four species of *Sicyos* occur in the USA. *Sicyos angulatus* is widespread in eastern states, while *S. glaber*, *S. lacinatus*, and *S. microphyllus* occur in Texas, New Mexico, and Arizona. A key, nomenclatural summaries, and morphological descriptions are provided. The three southwestern USA species are mapped at county level.

KEY WORDS: *Sicyos*, Cucurbitaceae, USA

In the Texas flora Correll and Johnston (1970) treated five species of *Sicyos*: *S. ampelophyllus*, *S. angulatus*, *S. glaber*, *S. lacinatus*, and *S. parviflorus*. Johnston (1990) added *S. microphyllus* to this group — "according to Henrickson (personal communication 1985) found in the Davis and Chisos mountains." Martin and Hutchins (1981) included *S. glaber*, *S. lacinatus*, and *S. parviflorus* in their account of New Mexican plants. Kearney and Peebles (1960) recognized *S. ampelophyllus* and *S. lacinatus* as occurring in Arizona. Rodríguez Arévalo (2001) has studied the genus in Mexico, but the thesis is unpublished and I have not seen it.

Recently, Turner et al. (2003) took a conservative view and mapped only two species for Texas, *S. angulatus* and *S. microphyllus*, indicating that the latter included plants earlier identified by Correll and Johnston as *S. ampelophyllus*, *S. glaber*, and *S. lacinatus*. For the USA, the PLANTS Database (USDA, NRCS 2011) includes all five of the species treated by Correll and Johnston and adds *S. microphyllus* to the account, presumably following Johnston (1990). All of these species names except *S. angulatus* — which correctly applies to the eastern North American species — have been used to identify specimens in major herbaria of the southwestern USA (SEINET 2010).

In preparation of the FNANM Cucurbitaceae treatment and for its documentation, I have reviewed *Sicyos* taxonomy and provide here an account based on study of approximately 250 collections from ARIZ, BRIT-SMU-VDB, LL-TEX, NMC, and RM.

1. Fruits ovoid-beaked, 9–15 mm long; stigmas 3-lobed; eastern USA ..... 1. **Sicyos angulatus**
1. Fruits ovoid, 4–8 mm long; stigmas 2-lobed or 3-lobed; southwestern USA (trans-Pecos Texas, New Mexico, Arizona).

2. Fruits without bristles ..... 2. **Sicyos glaber**
2. Fruits with antrorsely barbellate bristles.

3. Staminate inflorescence 10–16-flowered, peduncle and floral axis 40–140 mm long; stigmas 3-lobed; mature stems glabrate to sparsely minutely stipitate-glandular; leaves mostly deeply lobed, sinuses (1/3) 1/2–2/3 to base, margins not dentate, evenly sharply indurate-apiculate, proximal pairs of lateral veins divergent from the edge of the basal sinus ..... 3. **Sicyos microphyllus**
3. Staminate inflorescence 3–10-flowered, peduncle and floral axis 3–25 mm long; stigmas 2-lobed; mature stems glabrescent but remaining villous and stipitate-glandular; leaves shallowly lobed to angulate, sinuses 1/5–1/4 to base, margins evenly and shallowly dentate with sharply

indurate-apiculate teeth, proximal pairs of lateral veins closely bordering the edge of the basal sinus ..... 4. **Sicyos laciniatus**

1. **SICYOS GLABER** Woot., Bull. Torrey Bot. Club 25: 310. 1898. **TYPE**: **USA**. New Mexico. Dona Ana Co.: Organ Mts, S of San Augustine Ranch, 5000 ft, 1 Sep 1897, *E.O. Wooton 606* (possible holotype: US; probable isotype: NY digital image!). *Wooton 606* is not housed at NMC; the US specimen is labeled as an "isotype" fide the type database, but the image is not available.

Annuals. **Stems** mostly glabrous to very sparsely hirsutulous, youngest portions sparsely villous with flattened hairs mixed with glandular-puberulent vestiture. **Leaves**: blades pentagonal-angulate to reniform-angulate, (3–)4–7 cm long, 5–9 cm wide, shallowly 5-angulate, sinuses 1/4–1/3 to base, terminal lobe deltate-acuminate, base concave to semicircular, margins evenly subfoliaceous-apiculate, ciliate, both surfaces hirsute-hispidulous with short hairs; proximal pair of lateral veins closely parallel to slightly divergent from the edge of the basal sinus; petioles 1–3(–4.5) cm long. **Pistillate inflorescence** 4–10-flowered, not enveloped by bracteal leaf, peduncle 5–8 mm long. **Staminate inflorescence** 6–22-flowered; peduncle plus axis 15–100(–140) mm long. **Pistillate flowers**: sepals mostly narrowly triangular, 0.5–1.5 mm long, not foliaceous; corollas 2–3 mm long, including the narrow tube; stigmas 2-lobed. **Staminate flowers**: corollas 2–4 mm long, greenish-yellow to yellow; stamens slightly exserted. **Fruits** ovoid, 4–6 mm long, glabrous to sparsely villosulous, without bristles.

Flowering Aug–Sep. Canyon bottoms, open slopes, talus, dry drainages, sycamore, juniper-mountain mahogany, chaparral; 1800–2000 m; New Mexico (Dona Ana Co.), Texas (Brewster, Culberson, El Paso, Jeff Davis cos.); probably in Chihuahua, Mexico, but apparently not documented from there. Distribution mapped in Figure 2.

Additional collections examined. **NEW MEXICO. Dona Ana Co.**: Organ Mts.: Dripping Springs-Boyd Ranch, rocky canyon on an open slope on the W face of the Organ Mts., ca. 6000 ft, 21 Oct 1950, *Dunn 7242* (NMC); 5 km E of Las Cruces, Fillmore Canyon, wetland and below spring, canyon bottom, Baccharis glutinosa dominant, 6200 ft, 6 Oct 1989, *Skaggs s.n.* (NMC); Aguirre Springs Recreataion Area, Pine Tree Trail, entwined in Rhus trilobaata on dry , 30 degree, E-facing slope, 1819 m, 14 Sep 1991, *Skaggs 49* (NMC); Dripping Springs Natural Area, open talus slopes, entwined in Pericome caudate, 1830 m, 18 Sep 1991, *Skaggs 50* (NMC); Modoc, 28 Sep 1902, *Wooton s.n.* (NMC, RM); Soledad Canyon, 11 Sep 1904, *Wooton s.n.* (NMC); Filmore Canon, 23 Oct 1904, *Wooton s.n.* (NMC). [**Hidalgo Co.**: Guadalupe Mtns, Bottom Guadalupe Canyon, in shade of sycamores 22 Aug 1956, *Castetter 11272* (UNM, identified as *S. glaber* by D. Kearns, fide SEINET 2011)]. **TEXAS. Brewster Co.**: Big Bend National Park, Chisos Mts., Lost Mine Peak, ca 7300 ft, 12 Sep 1961, *Correll & Johnston 24538* (LL); Chisos Mts., 14 Aug 1931, *Mueller 8271* (TEX); Chisos Mts, rare vine below dam on trail to South Rim above Boot Spring, 6500 ft, 10 Sep 1950, *Warnock 9746* (LL, SMU). **Culberson Co.**: Guadalupe Mts., Pine Spring Canyon, flowers yellow, 29 Sep 1962, *Correll & Correll 26101* (LL). **El Paso Co.**: Franklin Mts., 0.5 air mi NE of the top of North Franklin Mountain, 6600 ft, 13 Oct 1984, *Worthington 12743* (NMC, TEX). **Jeff Davis Co.**: Davis Mts., infrequent above upper springs in Madera Canyon on Mt. Livermore, 7800 ft, 11 Sep 1947, *Warnock 7456* (LL, SMU-2 sheets, TEX).

The identity of this species is clear — Wooton described the fruits as "slightly compressed, ovoid, 5 mm long, entirely glabrous, the outer coat thin, the inner indurated, black, tuberculate-roughened." Other species of *Sicyos* also consistently have fruits without bristles, e.g., the Mexican *S. dieterleae* Rodriguez-Arevalo & Lira, *S. lirae* Rodríguez-Arévalo, *S. galeottii* Cogn., and *S.*

guatemalensis Standl. & Steyerm. (Lira 2001; Rodríguez Arévalo 2003), but none of them is known to occur north of Querétaro in central Mexico.

The distribution of *Sicyos glaber* in the USA (Fig. 2) directly suggests that the species also occurs at least in Chihuahua, but I have not encountered records from Mexico. None is listed in SEINET (2011) or in the distributed database available through CONABIO/REMIB (2008).

2. SICYOS LACINIATUS L., Sp. Pl. 2: 1013. 1753. *Cissus laciniata* (L.) L., Syst. Nat. (ed. 10) 2: 897. 1759. **LECTOTYPE** (Lombardi 1997, p. 430): *"Sicyos foliis laciniatis"* in Plumier in Burman, Pl. Amer., 239, t. 243, f. 1, 1760. Figure 3 in the present manuscript. Regarding provenance, the protologue has only "Habitat in America calidiori. … Plum. spec. 3." Burman also noted "Hoc genus IRSIOLA a *Brouw.* in *Hist. Jam.* p. 147. cocatur, ubi tres alias species a nostra differentes describit, quæ sub nomine *Bryoniæ* in *Sloan. Hist. Jam.* occurrunt."

The provenance of the illustrated plant presumably is either Hispaniola, from where it is recorded by Liogier (1986) or Mexico. No species of *Sicyos* is known from Cuba, Jamaica, Puerto Rico or the Lesser Antilles. McVaugh (2001) noted that "Cogniaux (1881) knew this species from central Mexico and the southwestern United States only; he cited no West Indian specimens, though he did cite Plumier's plate 243." Plants of *S. laciniatus* from Hispaniola presumably arrived there via long-distance dispersal from Mexico.

Sicyos vitifolius Willd., Sp. Pl. 4(1): 626. 1805. **SYNTYPES**: Provenance unknown, herb. Willdenow 18071 (B-Willdenow fiche 18071!). Three sheets in the Willdenow herbarium are identified as "*S. vitifolia*." None has provenance or other collection data. All show relatively deeply lobed leaves with dentate margins; two show very short staminate inflorescences).

The type, "taken from a cultivated plant of unknown provenance, probably from Mexico, is apparently a young flowering specimen of *S. laciniatus* L., with very short inflorescence, and coarsely toothed leaves having the primary lateral foliar veins curved and bordering the basal sinus." (McVaugh 2001, p. 643).

The protologue: "Habitat - - - - ⊙. (v.v.)." "Foliis semiquinquelobis dentatis, piloso-viscosis et odore *Salviae coccineae* diversissima. Floras masculi et feminei duplo minores quam in *S. angulata*. Tota planta pube tenuissima viscosa obsita. W."

Sicyos laciniatus var. *submteger* Cogn. in de Candolle, Monogr. Phan. 3:880. 1881. "Folia villosa vix hirsuta demum scabriuscula, leviter lobata, lobis late triangularibus non lobulatis." **SYNTYPES**: **USA. New Mexico**. 1851, *C. Wright 1091* (US; Boissier, BM, K, P). USA. New Mexico. "Ad flum. Rio Grande prope Doñana," Mex. Bound. Survey 390 (B, K, P). **Mexico**. *Scheide 1081* (B); *Ehrenberg 1081* (B); *Karwinsky s.n.* (Brussels); *Bourgeau 1058* (Boissier, Fournier, G-DC, K, L, P). Citations of herbaria are fide Cogniaux in the protologue.

The two collections from New Mexico are likely to be *Sicyos glaber*, from their geography. The others, from Mexico, presumably are *S. laciniatus*.

Sicyos ampelophyllus Woot. & Standl., Bull. Torrey Bot. Club 36: 111. 1909. **TYPE**: **USA**. New Mexico. Sierra Co.: Kingston, in and around the south end of the Black Range, in cultivated ground, ca. 2030 m, 5 Aug 1904, *E.O. Wooton 1195* (holotype: ?; duplicates: LL!, NY digital image!, TEX!, UNM). *Wooton 1195* is not housed at NMC, nor is it included in type databases of US or F.

Annuals. **Stems** (youngest portions) usually densely villous and stipitate-glandular, commonly glabrescent to a degree but remaining distinctly pubescent. **Leaves**: blades broadly ovate-angulate to reniform-angulate in outline, 3–5(–8) cm long, 4–11(–13) cm wide, shallowly 5-lobed,

lobes shallowly deltate to shallowly triangular or widely ovate, sinuses 1/5–1/4 to base, terminal lobe longer and broader, acuminate to acute, basal sinus broad-curved to nearly squarish, margins evenly and shallowly dentate, the teeth sharply indurate-apiculate, both surfaces hirsutulous-hispidulous, sometimes abaxially viscid-puberulent and sessile-glandular when very young, the glandularity deciduous by maturity; proximal pair of lateral veins closely bordering the edge of the basal sinus; petioles (1.5–)3–6(–8) cm long. **Pistillate inflorescence** 4–12-flowered, not enveloped by bracteal leaf, peduncle 2–4(–11) mm long. **Staminate inflorescence** 3–10-flowered; peduncle plus axis 3–25 mm long. **Pistillate flowers**: sepals linear to linear-triangular, 0.2–1.5 mm long, not foliaceous; corollas 1.5–2 mm long, including the narrow tube; stigmas 2-lobed. **Staminate flowers**: corollas ca. 2 mm long, white; stamens slightly exserted. **Fruits** ovoid, 5–6 mm long, glabrous, with antrorsely barbellate bristles.

Flowering Aug–Oct. Creek sides, floodplains, riparian woods, cottonwood-willow, juniper, oak, pine-oak, canyons, rocky slopes, cliff faces and bases; (1000–)1200–2400(–3000) m; Arizona (Apache, Cochise, Navajo, Pima, Yavapai cos.), New Mexico (Catron, Grant, Sierra, Socorro cos.), Texas (Jeff Davis Co.); Mexico ([Aguascalientes], Chiapas, Chihuahua, Coahuila, D.F., Durango, [Guanajuato], Hidalgo, [Jalisco], México, [Michoacan], Nuevo León, [Oaxaca], Puebla, [Querétaro], San Luis Potosí, Sinaloa, Sonora, [Tamaulipas], [Tlaxcala], [Veracruz], Zacatecas). Mexican states in brackets are cited by McVaugh (2001) and Lira (2001) but vouchers not seen in the present study. Distribution mapped in Figure 1.

Kearney and Peebles (1960) noted that *Sicyos laciniatus* var. *subinteger* was a synonym of *S. ampelophyllus*, the only species recorded here for Arizona. Their inclusion of *S. laciniatus* sensu stricto in the Arizona flora (based on "Lemmon in 1882" from Cochise Co.) reflected their interpretation that the two species were differentiated on leaf morphology. The lectotype of *S. laciniatus* (Fig. 3) has deeply lobed leaves (hence the epithet) — the morphology of this populational variant is more common in the southern part of the range of the species. As noted by McVaugh (2001, p. 643), "What he [Cogniaux] called var. *genuina* was the form with leaves lobed to the middle or more deeply, the lobes oblong and more or less lobulate. His var. *subintegra*, with leaves lightly lobed, the lobes broadly triangular and not lobulate, included specimens collected by the U.S.-Mexican Boundary Survey."

Additional collections examined. **ARIZONA. Apache Co.**: White Mts., ca. 5 mi SW of Eagar near bridge over Little Colorado River, Big Lake Road, climbing over shrubs, 7000 ft, 17 Sep 1963, *Barr 63-470* (ARIZ); Apache Natl Forest, mesa on E side of Murray Basin, ca. 2 air mi E of Flat Top, ca. 4.5 mi SE of Springerville, climbing in pinyon, 7500-7640 ft, 21 Sep 2005, *Nelson 67089* (RM). **Cochise Co.**: San Pedro Riparian Natl. Conservation Area, Upper San Pedro River floodplain, "Cottonwood" site, ca. 1 mi S of Hwy 90, ca. 200 m E of San Pedro, riparian, cottonwood understory, 7 Sep 2001, *Makings 783* (ARIZ, ASU-digital image!). **Chiricahua Mts.**: Cave Creek Canyon near Portal, 4900 ft, 26 Aug 1964, *Barr 64-478* (ARIZ); Paradise, 5300 ft, shady alluvium, 23 Sep 1907, *Blumer 1719* (ARIZ, NMC); Cave Creek Canyon, 21 Sep 1929, *Harrison, Kearney, and Hastings 6146* (ARIZ); Paradise, 5398 ft, 9 Oct 1966, *Hesselberg s.n.* (ARIZ); along road from Portal to Onion Saddle, ca. 6800 ft, pine-juniper-Cercocarpus, 8 Sep 1996, *McLaughlin 7023* (ARIZ); road from Cave creek to Rustler Park, 1.9 mi above jct with road to Paradise at Turkey Creek, 1.4 mi below Onion Saddle, pine-oak woodland, vine on roadside shrub at foot of cliffs, 7200 ft, 1 Sep 2001, *Sanders 24708* (TEX). **Huachuca Mts.**: Copper Creek, 5 Nov 1937, *Goodding 6618* (ARIZ); Fort Huachuca Military Reservation, along base of jumbled limestone cliffs, E-facing ridge, pine-oak-Cercocarpus association, ca. 7000 ft, 15 Sep 1989, *Reichenbacher 2815* (ARIZ). **Mule Mts.**: Golden Eagle Box Canyon, dense vegetation on rocky slope, 14 Sep 1955, *Goodding 26-55* (ARIZ); Banning Creek Canyon, ca. 2.5 mi NW of the tunnel at Bisbee on Hwy 80, O.F. Clarke property on the steep rocky slopes below Juniper Flats, oak woodland, locally common vine near the stream on the canyon

bottom S of the hwy, 5600 ft, 31 Aug 1984, *Sanders et al. 5257* (ARIZ, TEX). **Greenlee Co.**: Apache Forest, Upper Eagle Creek, riparian zone, 5150 ft, 28 Sep 1977, *Pase 2277* (RM). **Navajo Co.**: 5 miles W of Taylor on road to Pinedale at U.S. Forest Service Boundary, in shade of juniper near low meadow, 5900 ft, 9 Oct 1966, *Bohrer 1171* (ARIZ). **Pima Co.**: Catalina Mts., 4000 ft, 19 Aug 1903, *Jones s.n.* (RM); Rincon Mts. Dec 1907, *Goodding 12* (ARIZ). **Yavapai Co**: ca 2 km WSW of the confluence of Apache and Walnut Creeks, flood plain of moist dark brown soil, 1593 m, 1 Oct 1992, *Baker 10281* (ASU); Mingus Mountains 20 Sep 1936, *Goodding s.n.* (ARIZ); Prescott, 19 Sep 1926, *Loomis 3125* (ARIZ); Prescott, 8 Aug 1926, *Peebles, Harrison, & Kearney 2688* (ARIZ); Prescott, 1 Sep 1894, *Toumey s.n.* (ARIZ). **NEW MEXICO. Catron Co.**: Glenwood, shady areas under forest trees, 23 Sep 1941, *Hershey 2765* (NMC). **Grant Co.**: Ft. Bayard, 21 Sep 1907, *Barney s.n.* (NMC); 15 mi above Mimbres, Gila Wilderness Area, Mimbres River, moist sandy loam, 28 Aug 1966, *Crutchfield 2131* (LL); Lake Roberts, where Sapillo Creek enters the lake, low rocky shelf, 5800 ft, 20 Sep 1972, *Klue GAK-62* (ARIZ); US Hwy 180 where it crosses the Gila River just S of Cliff, sandy silt in shade of *Populus*, *Salix*, *Acer*, 13 Oct 1982, *Spellenberg 6866* (NMC). **Sierra Co.**: White Sands Missile Range, San Andreas Mts., Rhodes Canyon, Range Road 6, 11.7 mi from Road 7, limestone cliff face, 1710 m, 28 Sep 1989, *Herman 130* (NMC); White Sands Missile Range, ca. 57 air km E of Truth or Consequences in N part of San Andreas Mts., lower end of Rhodes Canyon, between Bear Den Canyon and Bosque Canyon, 0.1 mi E of Bosque Canyon, slopes below N-facing limestone cliffs, 9 Sep 1990, *Spellenberg & Hoban 10624* (NMC). **Socorro Co.**[?]: SE of the Mogollon Mts.,Sapello Creek, 6000 ft, 22 Aug 1900, *Wooton s.n.* (NMC). **Texas. Jeff Davis Co.**: Davis Mts., Mt. Livermore, upper slopes and near the peak, locally common vine, spreading on various plants, rocky knobs just S of peak, viscid, 4 Sep 1982, *Powell 3924* (TEX).

3. SICYOS MICROPHYLLUS Kunth in A. von Humboldt et al., Nov. Gen. Sp. 2(qto.): 119; 2(fol.): 95. 1817. **TYPE: Mexico**. Michoacan. "Crescit in monte ignivomo Jorullo, alt. 540 hex. (Regno Mexicano)?" (holotype: P fiche!, photos F, GH, MICH).

Elements of the description: " FOLIA alterna, petiolata, profunde sinuato-cordata, subseptemloba, denticulata, reticulato-quinquenervia, scabriuscula, membranacea, pollicem lata; lobis acutis aut subacuminatis, infimis minimis. PETIOLA 8-9 lineas longi, pilosi. ... RACEMI MASCULI axillares, longissime pedunculati, adjecto pedunculo subquadripollicares. FLORES longe pedicellati, paullo majores quam in praecedente; pedicellis, pedunculo et rhachi pilosis. PEDUNCULI FEMINEI in eadem axilla cum masculis, tres aut quatuor lineas longi, pilosiusculi. Flores nonnulli (4-5) capitato-congesti, subsessiles. ... PEPONES quatuor aut quinque, capitato-congesti, sessiles, ovati, compressiusculi, monospermi, echinis longis setiformibus scabris dense obsiti, magnitudine semini pomi."

Sicyos echinocystoides Cogn. in Rose, Contr. U.S. Natl. Herb. 3: 319. 1895. **SYNTYPES: Mexico. Nayarit**. Tepic, 5 Jan–6 Feb 1892, *Dr. E. Palmer 1894* (US, 2 sheets; isosyntypes: GH, NY digital image!). As synonym of *S. microphyllus* fide McVaugh (2001); the GH and NY sheets were annotated as *S. longisepalus* Cogn. by I. Rodriguez in 1997.

Sicyos deppei G. Don, Gen. Hist. 3: 34. 1834. **TYPE** (not designated): **Mexico. Veracruz**. "Near Jalapa." Don cited "Sicyos, nov. sp. Schlecht. et Cham. in Linnaea. vol. 5. p. 88 [1930]" and his description is no more than a translation of the Latin description provided by Schlectendahl and Chamisso.

Don's protologue: "Leaves broadly cordate, 7-lobed; lobes acuminated, middle lob the longest; margins densely denticulated, rough on both surfaces from conical hairs; male racemes elongated; fruit glomerate, ovate, nearly glabrous, but beset with strong retrograde prickles. O. S. Native of Mexico, near Jalapa. Flowers smaller than those of *S. angulatus*, but larger than those of *S. parviflorus*. ... Seeds the size of those of *Citrus medica*."

Sicyos deppei was used as the name of this species by Rodriguez Jimenez (1985) and Lira (2001), the latter acknowledging, fide a personal communication from McVaugh, that it might be a synonym of *S. microphyllus*. McVaugh (2001) explicitly included *S. deppei* as a synonym of *S. microphyllus*, and his lead is followed here. Use of *S. deppei* — vs. the earlier name by Kunth — apparently stems from Cogniaux (1881), who placed *S. microphyllus* in synonymy of *S. deppei*.

Sicyos collimus Rob. & Fern., Proc. Amer. Acad. Arts 30: 116. 1894. **SYNTYPES**: **Mexico. Chihuahua**. Cañon de San Diego, 17 Sep 1891, *C.V. Hartman 773* (GH; isolectotypes: NY digital image!, PH digital image!, US). Hills near Chihuahua, 23 Oct 1885, *C.G. Pringle 568* (GH, presumably). "A species near *S. Deppei* Don, but with leaves smaller and somewhat more acutely lobed, peduncles and inflorescences nearly or quite glabrous; petioles and pedicels shorter; and male flowers a little shorter."

Annuals. **Stems** (youngest portions) sparsely puberulent with stipitate-glandular hairs, often also hirsute-villous with viscid hairs, strongly to weakly glabrescent. **Leaves**: blades orbicular-pentagonal in outline, 4–10 cm long, (4–)6–12 cm wide, deeply lobed, sinuses (1/3–)1/2–2/3 to base, lobes deltate-acuminate to oblong-oblanceolate or obtrullate, basal sinus narrow to broad, margins sometimes with a few shallow, serrate teeth, not dentate, evenly sharply indurate-apiculate, barely scabrous, not ciliate, both surfaces hirsute to hispid-hirsute; proximal pair of lateral veins divergent from the edge of the basal sinus; petioles (1–)2–4(–7) cm long. **Pistillate inflorescence** 4–10-flowered, not enveloped by bracteal leaf, peduncle (0–)1–5(–10, 20) mm long. **Staminate inflorescence** 10–16-flowered; peduncle plus axis 40–140 mm long. **Pistillate flowers**: sepals mostly triangular, 0.2–2 mm long, not foliaceous; corollas 1–2 mm long, without a tube; stigmas 3-lobed. **Staminate flowers**: corollas 2–3 mm long, greenish white; stamens not exserted. **Fruits** ovoid, 5–8 mm long, sparsely and finely villous, with antrorsely barbellate bristles.

Flowering Sep–Oct. Rocky slopes and ridges, cliff bases, stream sides, yellow pine woodland, thickets; 2200–2600 m; New Mexico (Lincoln, Otero cos.), Texas (Jeff Davis Co.); Mexico (Chiapas, Chihuahua, Coahuila, [Colima], D.F., [Durango], [Guanajuato], [Guerrero], Hidalgo, Jalisco, México, Michoacan, Morelos, [Nayarit], [Nuevo León], Oaxaca, Puebla, [Querétaro], San Luis Potosí, Sinaloa, Sonora, [Tlaxcala], Zacatecas, Veracruz). Mexican states in brackets are cited by McVaugh (2001) and Lira (2001) but vouchers not seen in the present study. Distribution mapped in Figure 2.

Additional collections examined. **NEW MEXICO. Lincoln Co.**: near Gray, ca. 6000 ft, 6 Sep 1898, *Skehan 104* (NMC); White Mts., Jul-Aug 1898, *Townsend 28* (NMC); White Mts., Eagle Creek, 5 mi below crossing, 19 Sep 1899, *Turner s.n.* (NMC); White Mts., 7200 ft, 15 Aug 1897, *Wooton 346* (NMC, RM). **Otero Co.**: 21 mi SE of Cloudcroft, base of cliffs in yellow pine forest, 23 Aug 1956, *Waterfall 12966* (TEX); Sacramento Mts., Tularosa Creek, 18 Aug 1899, *Wooton s.n.* (NMC-2 sheets, RM). **[Torrance Co.**: Manzano Mts., Priest Canyon, 27 Sep 2002, Jercinovic 271 (UNM fide SEINET 2011)]. **TEXAS. Jeff Davis Co.**: **Davis Mts.**: Mt. Livermore, trailing on boulders near summit, 20 Sep 1966, *Correll 33742* (LL); Sawtooth Mt., upper slopes and on summit, 11 Sep 1967, *Correll 34982* (LL); Mt. Livermore, Oct 1934, *Hinckley s.n.* (TEX); Mt. Livermore, Oct 1935, *Hinckley s.n.* (TEX-2 sheets); Mt. Livermore, Oct 1978, *Johnston s.n.* (TEX); near foot of Sawtooth Mountain, thickets along small rocky creek, 4 Oct 1926, *Palmer 31932* (TEX); Mt. Livermore, upper slopes near the peak, locally common vine, spreading on various plants, rocky knobs just S of peak, 4 Sep 1982, *Powell & Powell 3924* (TEX); infrequent above upper springs in Madera Canyon on Mt. Livermore, 7800 ft, 11 Sep 1947, *Warnock 7456* (LL, SMU-2 sheets, TEX).

4. **SICYOS ANGULATUS** L., Sp. Pl. 2: 1013. 1753. **LECTOTYPE** (Jeffrey in Jarvis et al. 1980, p. 88) : Herb. Clifford 452, *Sicyos* 1 (BM 000647449 digital image!). The protologue notes "Habitat in Canada, Mexico."

Annuals. **Stems** moderately to densely villous-puberulent with glandular-viscid hairs, mixed with stipitate-glandular hairs. **Leaves**: blades orbicular-angulate to broadly ovate-angulate in outline, 4–12 cm long, 6–17 cm wide, shallowly 5-lobed to 5-angulate, terminal lobe deltate-acuminate to ovate-acuminate, basal sinus narrow to broad, margins evenly and minutely green-apiculate, minutely to prominently ciliate with gland-tipped hairs, both surfaces hispidulous-hirsute; proximal pair of lateral veins divergent from the edge of the basal sinus; petioles 1–7(–10) cm long. **Pistillate inflorescence** 8–16-flowered, not enveloped by bracteal leaf, peduncle 20–50 mm long. **Staminate inflorescence** 10–21(–34)-flowered; peduncle plus axis 30–220 mm long. **Pistillate flowers**: sepals linear to linear-triangular, 0.5–1 mm long, not foliaceous; corollas 1–2 mm long, without a tube; stigmas 3-lobed. **Staminate flowers**: corollas 4–5 mm long, white to greenish-white; stamens prominently exserted. **Fruits** ovoid-beaked, 9–15 mm long, densely villous to minutely villosulous or glandular-villosulous, with antrorsely barbellate bristles.

Flowering Jun–Oct(–Nov). Stream and river banks, creek bottoms, alluvial floodplains, disturbed woods, thickets, clearings, vacant lots, fallow fields, railroad banks; 0–300 m. Canada: Ontario, Que. USA: Ala., Ark., Conn., Del., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Nebr., N.H., N.J., N.Y., N.C., N.Dak., Ohio, Okla., Pa., R.I., S.C., S.Dak., Tenn., Tex., Vt., Va., W.Va., Wisc. Reported by Randall (2007) as invasive in Europe (Austria, Czech Republic, England, Finland, France, Hungary, Italy, Russia, Spain) and Asia (Japan, South Korea, Taiwan). Not mapped.

In Texas, at the southwestern corner of its range, *Sicyos angulatus* occurs only in a narrow, north-south band along the eastern margin of the Edwards Plateau (see Turner et al. 2003), continuing northward in Oklahoma. There is a broad gap through east Texas and eastward to where the distribution picks up in central Louisiana. The peculiar distribution in Texas appears to be a biological reality. Fruits in Texas may average slightly smaller but I can find no other difference between the Texas plants and those elsewhere in the range.

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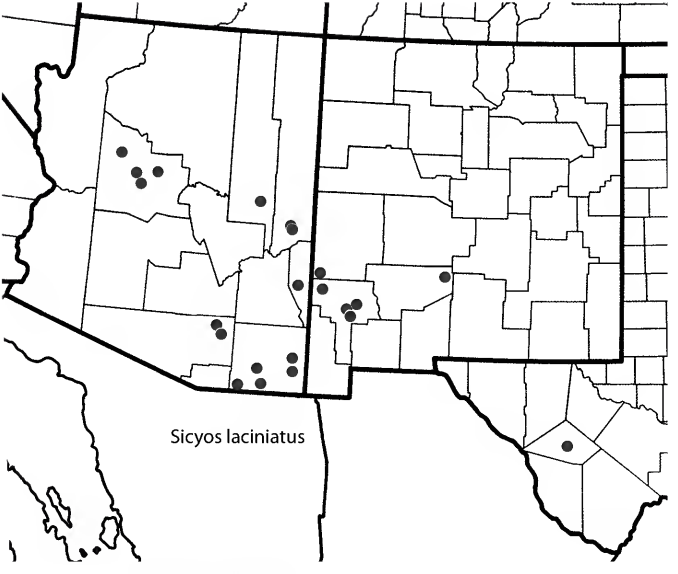

Figure 1. Distribution of *Sicyos laciniatus* in the USA.

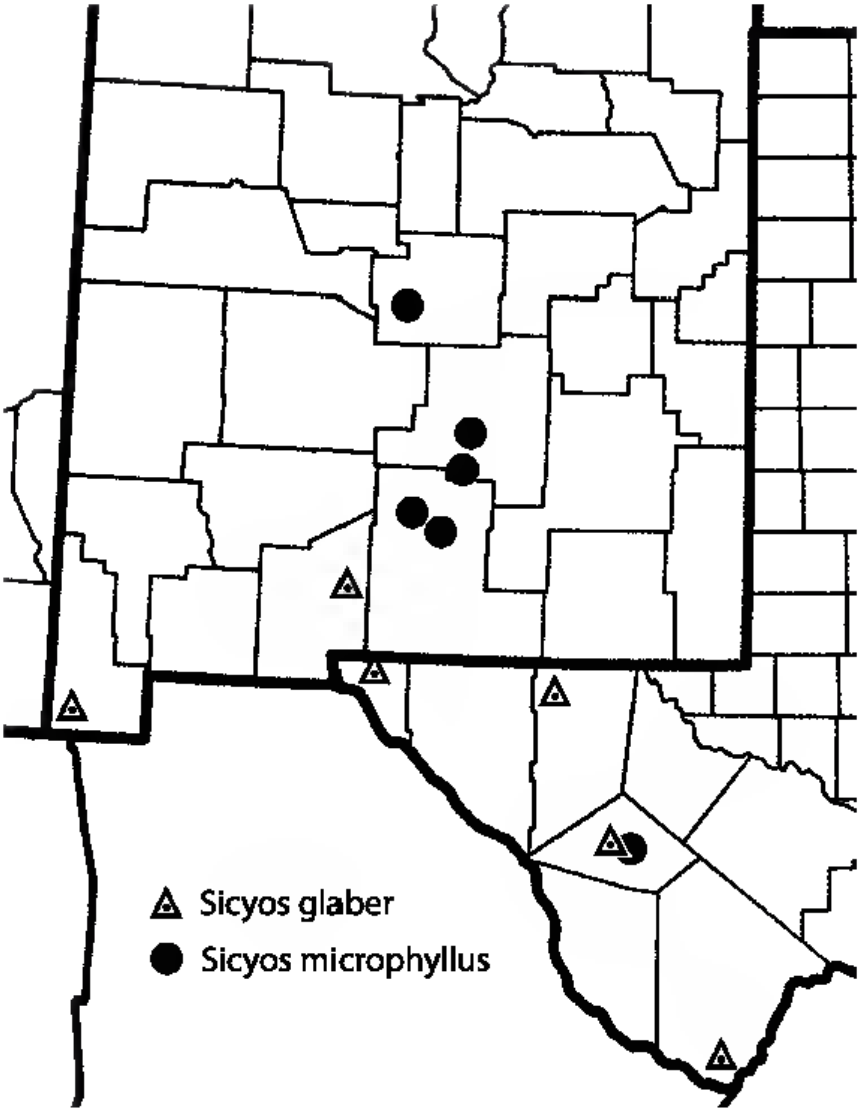

Figure 2 Distribution of *Sicyos glaber* and *Sicyos microphyllus* in the USA

Figure 3. Lectotype of *Sicyos laciniatus* "*Sicyos foliis laciniatis*" — Plumier in Burman, Pl Amer , 239, t. 243, f. 1, 1760.

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EPIPHYTES AND THE NATIONAL WETLAND PLANT LIST

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ABSTRACT

The National Wetland Plant List (NWPL) is a list of species that occur in wetlands in the United States. It is a product of a collaborative effort of four Federal agencies: the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the Natural Resources Conservation Service. The NWPL has many uses, but it is specifically designed for use in wetland delineation for establishing the extent of Federal jurisdictional of wetland boundaries. To be listed in the NWPL, a plant must be rooted in soil, so there is a direct relationship between a plant's occurrence and its preference for hydric soils. This relationship, coupled with the plant's frequency of occurrence in wetlands, is used to place it in one of five categories representing the probability that the plant occurs in a wetland. Many species are considered to be epiphytes, but they represent various life forms, ranging from purely epiphytic to frequently occurring on the ground. Based on a literature review of 192 species across the United States and its territories, we determined which species fell into four categories of epiphytic life forms or are terrestrial and should not be considered epiphytes. Of the 192 species reported as epiphytes, 33 were determined to be terrestrial and 107 can grow on the ground for at least part of their life forms. Only these 140 species will be retained in the NWPL. This review documents the process of evaluating which epiphytes qualify for being retained on the NWPL. Documentation includes the literature and its review to support retaining the species on the NWPL. The reasoning behind removing *Cuscuta* from the list is also documented.

KEY WORDS: wetlands, wetland plants, epiphytes, National Wetland Plant List, wetland delineation

The National Wetland Plant List (NWPL) is used in wetland delineation and restoration of wetlands, as well as providing a resource of botanical information about wetland plants. Each species determined to be a wetland plant has been placed in one of five rating categories representing the estimated probability, or frequency, with which it is thought to occur in wetlands, as opposed to nonwetlands, across its entire range (Table 1). These category assignments were developed through a thorough review of the botanical literature and the best professional judgment of national and regional experts.

Currently the NWPL is being revised under the administrative direction of the U.S. Army Corps of Engineers with cooperation from the U.S. Fish and Wildlife Service (USFWS), the U.S. Environmental Protection Agency, and the Natural Resources Conservation Service. The designated list for wetland delineation under Section 404 of the Clean Water Act is the 1988 list (referred to here as the "88 list") (Reed 1988). The NWPL was updated in 1996 (referred to here as the "96 list," as posted in a USFWS draft web publication) (Reed 1998), but the update was never officially finalized.

The current revision of the NWPL will be based on more precise scientific criteria than for previous lists, it will reflect changes in botanical nomenclature, and it will be divided into new geographic regions based on ecological rather than political boundaries. Proposed changes in wetland ratings will be vetted by botanists and wetland ecologists on regional and national panels, states, academics, and the public using a national database with a web interface. The revision of the NWPL includes an ongoing effort to assess the entire flora of the United States and its territories to ensure that the list is comprehensive and complete.

Epiphytes — plants that grow on or are attached to other living plants (Schimper 1888) — are a complication for the NWPL. In preparing previous wetlands lists, the USFWS applied an unpublished rule that no epiphytes were to be included because they are not rooted in the soil (Reed, USFWS, pers. comm.). The U.S. Army Corps of Engineers (Environmental Laboratory 1987) defined the hydrophytic vegetation community for wetland delineation purposes as "the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present." Under this definition, plants not rooted in the soil, which the USFWS assumed to include epiphytes, cannot be considered hydrophytes.

Epiphytes are a diverse taxonomic group, with species in at least 33 families and over 230 genera worldwide. When hemi-epiphytic plants are included — species that can be both epiphytic and occur on the ground — the number of families increases to 83 and the number of genera to over 875 (Gentry & Dodson 1987). About 80% of all vascular epiphytes are monocotyledons (Kress 1989).

A review of the literature quickly reveals that epiphyte species have a variety of life forms and occur in a variety of habitats (Gentry & Dodson 1987, Wagner et al. 1999, Acevedo-Rodriguez 2005), bringing the simplistic no-epiphyte wetland rule into question. One life form that may violate the logic behind the no-epiphyte rule is that of hemi-epiphytes. This group contains two forms with different life forms, sometimes described as primary and secondary epiphytes. Primary hemi-epiphytes begin their life form as epiphytes and later become rooted in the ground. Secondary hemi-epiphytes begin life rooted in soil and later assume an epiphytic life form and are no longer rooted in the soil (Putz & Holbrook 1989). Some species in both these hemi-epiphytes groups may warrant consideration as wetland species, and it is possible that epiphytes with other life forms should be considered as well.

The current efforts to update the NWPL includes 192 epiphytes or hemi-epiphytes, primarily because earlier wetland plant lists by the USFWS had assigned wetland ratings to 122 epiphytic species, even though this was in opposition to their own basic rule not to include any epiphytes. The discovery of these epiphytes on the list prompted further investigation to see if any epiphytes met the rule of needing to be rooted in the ground.

To support the scientific quality of the NWPL, we compiled a draft list of various categories of epiphytes, evaluated the literature to develop ecological profiles of their life forms, and compiled literature references to support the groupings of epiphytes for further consideration as wetland species. The information presented here will support the updating of the NWPL for epiphytes and will provide background for those species that could considered to be wetland plants and that should be evaluated for a wetland rating.

Methods.

A list of potential epiphytes that may warrant further consideration as wetland plants was obtained as a collaborative effort with BONAP (Biota of North America Program). Kartesz (in press) tracks the flora of North America and maintains an extensive database of distribution and biological attributes based on a national inventory of herbaria, scientific literature, and information from recognized specialists in many groups of plants. The BONAP database already contains a list of epiphytes known within the United States and its territories, but the list is limited to a general category identified only as epiphytes.

To identify whether some part of an epiphyte's life form includes being rooted on the ground, we sorted the epiphyte list into five categories. We reviewed 59 literature sources to determine the life form of each of the potential epiphyte species and to place each species into one of the categories.

1. **Obligate epiphytes on trees**. These are true epiphytes, i.e., non-parasitic plants anchored to the stems or trunks of trees or shrubs or occasionally on moss mats but never found growing on the ground.

2. **Obligate epiphytes on rocks**. These epipetric plants are anchored to rocks, boulders, or cliffs rather than to other plants but are never found on the ground.

3. **Facultative epiphytes of trees and terrestrial sites**. These plants can occur either on tree trunks or stems or on the ground in soil (but not on rocky cliffs or boulders). They are never restricted to a true epiphytic life form. This group includes both categories of hemi-epiphytes.

4. **Facultative epiphytes of rock and terrestrial sites**. These plants can be either epipetric or they can grow in soil on the ground, but they are never true epiphytes on tree trunks or branches.

5. **Not epiphytic**. These plants are primarily terrestrial or at least rooted in soil on the ground. This group includes climbers with adventitious roots, lianas, and species that lean on other plants for support at maturity but are not rooted to the host plant.

Additionally, the genus *Cuscuta* (dodder) was evaluated as a possible epiphtye. This genus was not on the 88 and 96 lists. However, during the current update process, many people have submitted the suggestion that this genus and some of its species deserve wetland ratings. This genus is scattered throughout most of North America and is frequently found in wetlands.

Results.

Within the continental USA, Puerto Rico, Hawaii, and the Marianas in the south Pacific (Figure 1), the area covered by the NWPL, there are 192 species reported to be epiphytes by BONAP (Table 1). Of these, 52 are obligate epiphytes of trees or rocky cliffs and do not qualify as potential wetland plants. Thirty-three species are primarily terrestrial and rarely (if ever) have a true epiphytic or epipetric life form. It is possible that some of these species may be wetland plants, but they need to be assessed during the updating process of the NWPL. A total of 107 species were found to be facultative epiphytes (or epipetric species) that also occur in various terrestrial environments and are rooted in soil during part of their life form. These species need to be evaluated as part of the updating process of the NWPL to determine if their frequency of occurrence in wetlands meets wetland indicator standards.

Of the 122 species of epiphytes that had been assigned wetland indicator ratings on the 88 and 96 lists, 91 were categorized as facultative epiphytes in our review and 31 were categorized as obligate epiphytes that did not occur on the ground (Table 2). Of the remaining 70 species that are reported here as epiphytes, the USFWS had assigned many of these species into two other categories; these categories were "No Occurrence (NO) in any USFWS region," which had 15 species, and "Not

enough Information to make a determination (NI)," which had 55 species. Voucher specimens now exist to verify the occurrence of the species in the NO group in various locations of the U.S.

***Cuscuta* (dodder).**

Cuscuta, in the Convolvulaceae family, is a genus of annual parasitic plants with a worldwide distribution. In the USA they occur in every state except Alaska (BONAP 2010). *Cuscuta* spp. are considered holoparasites — they depend entirely on their hosts for water and nutrients (Albert et al. 2008). Most species lack chlorophyll, and for those that do have chlorophyll, photosynthesis provides for only a small amount of the plant's needs. *Cuscuta* spp. are considered pests on a wide variety of plants, many of agricultural significance.

Cuscuta seeds germinate on or near the soil surface in a variety of habitats. As the rootless, leafless stem grows, it rotates and coils around any vertical object. If the object is a suitable host, the *Cuscuta* stem secretes an adhesive substance and induces the host to do the same. Then *Cuscuta* grows haustoria, which are root tips that penetrate the host tissue and provide a pathway for water, nutrients, and other compounds. At this point, the *Cuscuta* plant becomes detached from the soil and has no more contact with the ground throughout the rest of its life. Once established on a host, *Cuscuta* grows rapidly and can spread easily to nearby hosts. *Cuscuta* plants flower from late spring to fall, and each plant can produce thousands of small seeds, which can remain viable in the soil for 10 years or more.

Cuscuta's life form as a holoparasite and its ability to break connection from the soil shortly after germination when it begins its parasitic phase supports its elimination from the NWPL as previously interpreted in the unpublished rule of the USFWS that wetland plants need to be rooted in soil.

Discussion.

During the process of updating the NWPL over the past three years, all 192 species of epiphytes evaluated in this review were included on the update list, since over half of them had a previous wetland ratings in 88 and 96 lists. Some species had already been rated as wetland plants but had not been vetted for their life form to determine if they frequently occur on the ground, so we retained all 192 reported epiphytes on the NWPL until the public input phase is over. After the updating is complete but before the list is finalized, those species determined to be obligate epiphytes (including epipetric species) will be dropped from the NWPL. The remaining facultative epiphytes, including those that are epiphytic on trees and shrubs and on rocks, will be retained. All species retained, based on this review of their life form, that received a wetland indicator status during the review process will be included on the final NWPL.

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Table 1. Wetland Indicator Status Ratings and their cardinal rating categories, as described in the National List of Plant Species that Occur in Wetlands (Reed 1988).

Indicator Status (abbreviation)	% Occurrence in Wetlands
Obligate (OBL)	99
Facultative Wetland (FACW)	67–99
Facultative (FAC)	34–66
Facultative Upland (FACU)	1–33
Upland (UPL)	1

Table 2. Epiphytes in the United States and its territories.

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Araceae								
Anthurium crenatum	Scalloped laceleaf	Puerto Rico			X			Terrestrial or epiphytic herb in shaded moist forests and scrub forests, according to Acevedo-Rodriguez and Strong (2005)
Anthurium dominicense	Lengua de vaca	Puerto Rico			X			Terrestrial understory herb or epiphyte in moist forests (Acevedo-Rodriguez & Strong 2005)
Epipremnum pinnatum	Devil's ivy	Florida, Hawaii, Puerto Rico					X	Root-climbing vine, non-native and escaping in Florida, persisting in hammocks and on roadside trees (Thompson 2000); cultivated and escaping in Puerto Rico (Acevedo-Rodriguez &Strong 2005).
Monstera deliciosa	Tarovine	Florida, Puerto Rico, Virgin Islands					X	Scandent (climbing) or decumbent shrub; cultivated in Puerto Rico but not thought to be established in the wild (Acevedo-Rodriguez & Strong 2005)
Philodendron consanguineum	Rascagargant a	Puerto Rico, Virgin Islands					X	Root-climbing herb in moist and wet forests (Acevedo-Rodriguez & Strong 2005)
Philodendron erubescens	Blushing philodendron	Hawaii					X	"Erect, scrambling climber" rooting at nodes and in soil; native to Colombia, not considered naturalized in Hawaii, though grown there as an ornamental (Hogan 2003)
Philodendron giganteum	Giant philodendron	Puerto Rico, Virgin Islands			X			Terrestrial or epiphytic herb of moist forests in Puerto Rico (Acevedo-Rodriguez & Strong 2005)
Philodendron hederaceum	Vilevine	Puerto Rico, Virgin Islands					X	Vine, rooting at nodes in moist forests of low and middle elevations of Puerto Rico and the Virgin Islands (Acevedo-Rodriguez & Strong 2005)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Philodendron hederaceum var. *oxycardium*	Heartleaf philodendron	Puerto Rico, Virgin Islands					X	Included as a synonym of *P. hederaceum* by Acevedo-Rodriguez and Strong (2005); vine, rooting at nodes.
Philodendron lingulatum	Treelover	Puerto Rico, Virgin Islands					X	Root-climbing herb in moist and rain forests in Puerto Rico and the Virgin Islands (Acevedo-Rodriguez & Strong 2005)
Araliaceae								
Schefflera actinophylla	Octopus tree	Hawaii, Florida, Puerto Rico, Virgin Islands			X			Grows as a tree but can occasionally be epiphytic (Lowry 1999); native to Australia and New Guinea but widely cultivated outdoors in tropical climates or indoors as a houseplant
Schefflera arboricola	Dwarf umbrella tree	Taiwan					X	Cultivated house plant native to Taiwan; typically grows as a shrub (Hogan 2003); questionably epiphytic
Aspleniaceae								
Asplenum cirrhatum	Chestnut-scale spleenwort	Puerto Rico	X	X				Synonym = *A. radicans* var. *cirrhatum*; on mossy boulders and tree trunks (Proctor 1989) in wet forests (Liogier & Martorell 2000)
Asplenum erosum	Eared spleenwort	Florida, Puerto Rico	X					Synonym = *A. auritum*; cited as epiphytic on trunks of mature trees, especially on old live oaks (*Quercus virginiana*) with leaning trunks, or on the base of pop ash (*Fraxinus caroliniana*) and pond apple (*Annona glabra*) trees by Nelson (2000); also cited as epiphytic in the *Asplenum* key of Wagner et al. (1993, p. 231)
Asplenum formosum	Showy spleenwort	Puerto Rico			X	X		Occasionally epiphytic on mossy tree trunks on shaded boulders and ledges beside streams and on non-calcic banks (Proctor 1989)
Asplenum inaequilaterale	Royal spleenwort	Hawaii					X	Terrestrial in mesic to wet forests (Palmer 2003)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Asplenium juglandifolium	Walnut spleenwort	Puerto Rico			X			Cited as "epiphytic on tree trunks or in humus in wet forests at middle to higher elevations" in Puerto Rico (Liogier & Martorell 2000)
Asplenium nidus	Hawaii birdnest spleenwort	Hawaii			X			Epiphytic in trees or terrestrial in mesic to dry forests (Palmer 2003)
Asplenium pteropus	West Indian spleenwort	Puerto Rico			X			Epiphyte of lower montane wet forest (Croat 1978) or terrestrial in shaded humus (Proctor 1989)
Asplenium rhomboidale	Caribbean spleenwort	Puerto Rico		X				Shaded mossy boulders and ledges (Proctor 1989)
Asplenium serratum	Wild birdnest fern	Florida, Puerto Rico, Virgin Islands		X				Epiphytic on base of trees and on fallen logs and stumps (Lellinger 1985); other references cite as growing on rotten logs and stumps (Wagner et al. 1993)
Asplenium sphenotomum	Royal spleenwort	Hawaii			X			Synonym = *Asplenium insiticium*; terrestrial or occurs on low, mossy logs in mesic to wet forests (Palmer 2003)
Asplenium viride	Bright-green spleenwort	w and ne North America		X				Synonym = *Asplenium trichomanes-ramosum*; grows mostly on calcareous cliffs and rock (Lellinger 1985, Wagner et al. 1993).
Asteraceae								
Bidens discoidea	Small beggarticks	e North America					X	Questionably an epiphyte at all, though clearly a wetland species; cited as an annual forb of "ponds, swamps, other relatively wet sites" (Strother & Weedon 2006)
Blechnaceae								
Blechnum divergens	Ravine mid-sorus fern	Puerto Rico			X			Terrestrial or occasionally hemi-epiphytic (Moran 1995a); found in "wet montane forests, at higher elevations" in Puerto Rico (Liogier & Martorell 2000)
Blechnum insularum	Graceful mid-sorus fern	Puerto Rico	X					Mossy tree trunks and limbs in wet montane forests (Proctor 1989)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Bromeliaceae								
Ananas comosus	Pineapple	Florida, Puerto Rico					X	Terrestrial plant, not cited in the literature as being an epiphyte (Acevedo-Rodriguez & Strong 2005, Hogan 2003)
Hohenbergia antillana	Antilles lacebark	Puerto Rico			X	X		Epiphytic, terrestrial, or lithophytic herbs forming large colonies in thickets, woodlands, and moist forests in Puerto Rico and the Virgin Islands (Acevedo-Rodriguez & Strong 2005)
Pitcairnia angustifolia	Pina cortadora	Puerto Rico, Virgin Islands				X		Lithophytic or terrestrial herb in moist and wet forests from sea level to above 1000 m (var. *angustifolia*) or on ridges, slopes, streams, banks, and edges of forest in rocky wet montane forests (var. *simplicior*) (Acevedo-Rodriguez & Strong 2005)
Cactaceae								
Hylocereus costaricensis	Costa Rican night-blooming cactus	Hawaii					X	Stout climbers or vines native to Central America and introduced in Hawaii; mature plants may be supported by other vegetation but not cited as epiphytes per se (Anderson et al. 2001)
Hylocereus undatus	Night-blooming cactus	Hawaii, Florida, Puerto Rico, Virgin Islands			X			Hawkes (2003) describes growth habit as "sprawling or clambering over rocks, shrubs, and trees." Solomon (1999) describes the species as a sprawling terrestrial or epiphytic vine in Hawaii
Selenicereus grandiflorus	Queen of the night	Hawaii, Puerto Rico, Virgin Islands					X	Vine-like or rope-like cactus with clambering or trailing stems and with aerial roots (Benson 1982)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Campanulaceae								
Clermontia arborescens	Oha wai nui	Hawaii			X			Terrestrial or epiphytic trees or shrubs in mesic to wet forest (Lammers 1999)
Clermontia arborescens ssp. *arborescens*	Oha wai nui	Hawaii			X			Terrestrial or epiphytic trees or shrubs in mesic to wet forest (Lammers 1999)
Clermontia arborescens ssp. *waihiae*	Oha wai nui	Hawaii			X			Terrestrial or epiphytic trees or shrubs in mesic to wet forest (Lammers 1999)
Clermontia arborescens ssp. *waikoluensis*	Oha wai nui	Hawaii			X			Treated as a synonym of *C. arborescens* ssp. *waihiae* by Lammers (1999); terrestrial or epiphytic trees or shrubs of wet forests
Clermontia clermontioides	Kauai clermontia	Hawaii			X			Terrestrial or epiphytic shrubs or trees in mesic to wet forest (Lammers 1999)
Clermontia clermontioides ssp. *clermontioides*	Kauai clermontia	Hawaii			X			Terrestrial or epiphytic shrubs or trees in mesic to wet forest (Lammers 1999)
Clermontia clermontioides ssp. *rockiana*	Kauai clermontia	Hawaii			X			Terrestrial or epiphytic shrubs or trees in mesic to wet forest (Lammers 1999)
Clermontia drepanomorpha	Kohala mountain clermontia	Hawaii			X			Terrestrial or epiphytic trees in wet and low boggy forest (Lammers 1999)
Clermontia fauriei	Haha'aiakama nu	Hawaii			X			Terrestrial or epiphytic shrubs or trees in mesic to wet forest (Lammers 1999)
Clermontia grandiflora	Bog clermontia	Hawaii			X			Terrestrial or rarely epiphytic shrubs or trees of wet forest and margins of bogs (Lammers 1999)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Clermontia grandiflora ssp. *grandiflora*	Bog clermontia	Hawaii			X			Terrestrial or rarely epiphytic shrubs or trees of wet forest and margins of bogs (Lammers 1999)
Clermontia grandiflora ssp. *maxima*	Bog clermontia	Hawaii			X			Terrestrial or rarely epiphytic tree or shrub from streambanks in wet forest (Lammers 1991)
Clermontia grandiflora ssp. *munroi*	Bog clermontia	Hawaii			X			Terrestrial or rarely epiphytic shrubs or trees of wet forest and margins of bogs (Lammers 1999)
Clermontia hawaiiensis	Oha kepau	Hawaii			X			Terrestrial or epiphytic trees or shrubs of mesic to wet forest (Lammers 1999)
Clermontia kohalae	Waipio Valley clermontia	Hawaii			X			Terrestrial or epiphytic trees 2–6 m tall (Lammers 1999)
Clermontia montis-loa	Mauna Loa clermontia	Hawaii			X			Terrestrial or epiphytic trees or shrubs of wet forest (Lammers 1999)
Clermontia pallida	Wailai Pali Clermontia	Hawaii			X			Terrestrial or rarely epiphytic shrubs of wet forests (Lammers 1999)
Clermontia parviflora	Small-flower clermontia	Hawaii			X			Terrestrial or epiphytic shrubs of wet forests (Lammers 1999)
Clermontia persicifolia	Waioiani clermontia	Hawaii			X			Terrestrial or epiphytic shrubs or trees of wet forests (Lammers 1999)
Clermontia waimeae	Swamp-forest clermontia	Hawaii			X			Terrestrial or epiphytic shrubs or trees of bogs and wet forests (Lammers 1999)
Clusiaceae								
Clusia gundlachii	Gundlach's attorney	Puerto Rico					X	Clambering shrub, not specifically epiphytic, from moist forests along the Cordillera Central and Sierra de Luquillo in Puerto Rico (Acevedo-Rodriguez 2005)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Clusia minor	Cupey de monte	Puerto Rico					X	Erect shrubs, similar to *C. gundlachii*; not epiphytic (Acevedo-Rodriguez 2005)
Clusia rosea	Scotch attorney	Hawaii, Florida, Puerto Rico, Virgin Islands			X			Hemi-epiphytic tree, epiphytic as a seedling, becoming a strangler as the plant matures and ultimately a free-standing, rooted tree at full maturity (Luttge 2007)
Commelinaceae								
Murdannia nudiflora	Naked-stem dewflower	Hawaii, Puerto Rico, s USA					X	Prostrate or decumbent sub-succulent annual herb of weedy habitats in wet, open or disturbed sites from low to upper elevations (Acevedo-Rodriguez & Strong 2005, Fadden 2000). Apparently rarely, if ever, an epiphyte
Cyperaceae								
Carex decompositta	Cypress-knee sedge	se USA			X			Grows in "marshes, swamp forests, usually on rotten stumps, floating logs, or bases of trees (often *Taxodium*) or shrubs (*Cephalanthus*) on lake, pond, and slough margins" (Cochrane 2002)
Dryopteridaceae								
Dryopteris carthusiana	Spinulose wood fern	Canada, USA (except SW)				X		Questionably epiphytic; "terrestrial in moist to wet woods and swamps" (Lellinger 1985). Montgomery and Wagner (1993) note all *Dryopteris* taxa in North America as being terrestrial, rarely growing on rock
Dryopteris marginalis	Marginal wood fern	Greenland, Canada, e USA				X		Questionably epiphytic; "epipetric or terrestrial on rock ledges, talus slopes, and on soil in shade and exposed places" (Lellinger 1985). Montgomery and Wagner (1993) note all *Dryopteris* taxa in North America as being terrestrial, rarely growing on rock
Elaphoglossum aemulum	Creeping tongue fern	Hawaii			X			Terrestrial or occasionally epiphytic in closed-canopy mesic to wet forests in Hawaii (Palmer 2003)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Elaphoglossum alatum	Tall tongue fern	Hawaii			X			Terrestrial or occasionally epiphytic in closed-canopy mesic to wet forests on Oahu (Palmer 2003)
Elaphoglossum crassicaule	Tall tongue fern	Hawaii			X			Synonym = *Elaphoglossum alatum* var. *crassicaule*; terrestrial or occasionally epiphytic in closed-canopy mesic to wet forests of Kauai, Hawaii (Palmer 2003)
Elaphoglossum crassifolium	Royal tongue fern	Hawaii			X			Terrestrial or epiphytic in a variety of habitats, ranging from open mesic woods to wet forests and dense rain forests (Palmer 2003)
Elaphoglossum decoratum	Showy tongue fern	Puerto Rico			X			Epiphyte, rarely terrestrial (Moran 1995c); wet montane forests at high elevation in Puerto Rico
Elaphoglossum faurtei	Tall tongue fern	Hawaii			X			Synonym = *Elaphoglossum alatum* var. *faurtei*; terrestrial or epiphytic fern of mesic to wet forests of Oahu and Molokai (Palmer 2003)
Elaphoglossum paleaceum	Ekaha	Hawaii			X	X		Terrestrial, epipetric, or epiphytic fern in various habitats from mesic open woods to wet forests (Palmer 2003)
Elaphoglossum parvisquamaeum	Tall tongue fern	Hawaii			X			Synonym = *Elaphoglossum alatum* var. *parvisquamaeum*; terrestrial or epiphytic fern growing on moss in moist forests (Palmer 2003)
Elaphoglossum pellucidum	Jeweled tongue fern	Hawaii			X	X		Terrestrial, epipetric, or epiphytic vine-like fern of moist forests (Palmer 2003)
Elaphoglossum peltatum	Peltate tongue fern	Puerto Rico	X					Synonym = *Peltapteris peltata*; epiphytic (Moran 1995c)
Elaphoglossum wawrae	Island tongue fern	Hawaii			X			Epiphytic or terrestrial Hawaiian fern of mesic to wet forests (Palmer 2003)
Lomariopsis amydrophlebia	Royal fringed fern	Puerto Rico					X	Terrestrial fern with climbing rhizomes from moist forests of Puerto Rico (Acevedo-Rodriguez 2005)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Lomariopsis kunzeana	Holly-leaf fringed fern	Florida, Puerto Rico				X		Unlike all other species in the genus, *Lomariopsis kunzeana* rarely climbs trees and usually occurs in hammocks or limestone sinkholes (Moran 1993); Lellinger (1985) considers the species epipetric in limestone sinkholes
Nephrolepis brownii	Asian sword fern	Hawaii, Florida, Puerto Rico, Virgin Islands			X			Synonym = *Nephrolepis multiflora*, terrestrial or epiphytic (Nauman 1993b); *N. multiflora* considered naturalized from Asia (Lellinger 1985)
Nephrolepis cordifolia	Narrow sword fern	Hawaii, se USA, Puerto Rico, Virgin Islands			X	X		Terrestrial, epiphytic on palmetto, or epipetric on old walls (Lellinger 1985); can be terrestrial, epiphytic, or on old limestone walls and is probably not native in North America (Nauman 1993b)
Nephrolepis exaltata	Boston sword fern	Hawaii, se USA, Puerto Rico, Virgin Islands			X	X		Terrestrial or usually epiphytic in forested to open habitat (Nauman 1993b); may be terrestrial, epiphytic, or epipetric (Lellinger 1985)
Nephrolepis falcata	Fish-tail sword fern	Hawaii, Florida					X	Naturalized in Hawaii; terrestrial fern of mesic to wet forests at low elevation (Palmer 2003)
Nephrolepis rivularis	Streamside sword fern	Puerto Rico, Virgin Islands					X	Terrestrial fern of mesic habitats (Moran 1995b)
Nephrolepis × *copelandii*	Copeland's sword fern	Hawaii					X	Hybrid of *Nephrolepis cordifolia* × *N. multiflora*, considered naturalized in Hawaii; Palmer (2003) describes the parent species *N. multiflora* (native to India and tropical Asia) as terrestrial; hybrid found along trails

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Nephrolepis × *medlerae*	Medler sword fern	Hawaii					X	Hybrid of *Nephrolepis exaltata* ssp. *hawaiiensis* × *N. multiflora*; Palmer (2003) describes the parent species *N. multiflora* (native to India and tropical Asia) as terrestrial; hybrid found along trails at two sites on Oahu
Oleandra articulata	Oleander fern	Puerto Rico			X			Epiphytic or climbing by adventitious roots in moist forests at middle to upper elevations (Acevedo-Rodriguez 2005)
Ericaceae								
Symphysia racemosa	Leather-leaf eelvine	Puerto Rico					X	Synonym = *Vaccinium racemosum*; scandent or clambering shrubs from moist areas (Acevedo-Rodriguez 2005)
Fabaceae								
Arachis hypogaea	Peanut	se USA, Puerto Rico					X	Cultivated peanut is native to South America but is grown in the southeastern U.S. and may occasionally escape and become established; typically has decumbent stems but is scarcely an epiphyte or epipetric (Gleason & Cronquist 1991)
Gesneriaceae								
Columnea ambigua	Tibey de cresta	Puerto Rico	X					Epiphytic in trees in wet or moist forests and wooded hills in Puerto Rico (Liogier & Martorell 2000)
Grammitidaceae								
Adenophorus epigaeus	Kauai kihi fern	Hawaii	X					Epiphytic or epigeous (growing in moss mats at tree bases but above the ground surface); found in wet forests and bogs on Kauai only (Palmer 2003)
Adenophorus pinnatifidus var. *pinnatifidus*	Graceful kihi fern	Hawaii	X	X				Epiphytic or epipetric fern of mesic to wet forests and along shaded streambeds (Palmer 2003)
Adenophorus pinnatifidus var. *rockii*	Rock's graceful kihi fern	Hawaii	X	X				Epiphytic or epipetric fern of mesic to wet forests and along shaded streambeds (Palmer 2003)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Adenophorus tamariscinus	Wahini noho mauna	Hawaii	X					Epiphytic fern of wet-mesic to rain forests in Hawaii (Palmer 2003)
Adenophorus tamariscinus var. *montanus*	Maui kihi fern	Hawaii	X					Epiphyte found in or near bogs or near ground level in moss mats (Palmer 2003)
Adenophorus tamariscinus var. *tamariscinus*	Wahini noho mauna	Hawaii	X					Epiphytic fern of wet-mesic to rain forests in Hawaii (Palmer 2003)
Adenophorus tripinnatifidus	Royal kihi fern	Hawaii	X					Epiphytic fern of rain forests (Palmer 2003)
Cochlidium jungens	Mountain snail fern	Puerto Rico	X					Synonym = *Grammitis jungens*; epiphyte in montane scrub (Liogier & Martorell 2000, Smith 1995)
Cochlidium serrulatum	Toothed snail fern	Puerto Rico	X					Synonym = *Grammitis serrulata*; epiphyte in moist places at lower middle to high elevations (Liogier & Martorell 2000, Smith 1995)
Enterosora trifurcata	Three-fork polypody	Puerto Rico	X					Synonym = *Grammitis trifurcata*; epiphyte in wet montane forests (Liogier & Martorell 2000, Smith 1995)
Lellingeria myosuroides	Narrow dainty polypody	Puerto Rico	X					Synonym = *Grammitis myosuroides*; epiphyte in wet forests (Lellinger 1989, Liogier & Martorell 2000)
Terpsichore taxifolia	Yew-leaf dwarf polypody	Puerto Rico	X					Synonym = *Grammitis taxifolia*; epiphyte in forests of Central America (Lellinger 1989)
Hymenophyllaceae								
Callistopteris baldwinii	Baldwin's false filmy fern	Hawaii					X	Synonym = *Trichomanes bauerianum*; terrestrial fern "on wet banks or on soil in wet, mossy forests and along stream banks in mesic forests" (Palmer 2003)
Hymenophyllum microcarpum	Creeping filmy fern	Puerto Rico	X	X				Epiphytic on trunks or rarely epipetric (Lellinger 1989)

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			Tree	Rock	Tree/ terr.	Rock/ terr.		
Hymenophyllum polyanthos	Smooth filmy fern	Puerto Rico, Virgin Islands	X					Epiphytic on trunks and branches (Lellinger 1989)
Hymenophyllum wrightii	Wright's filmy fern	Alaska, British Columbia			X	X		Epiphyte on the bark of old Sitka spruce trees, as well as being terrestrial and epipetric (Lellinger 1985)
Mecodium recurvum	Ohi'a ku	Hawaii			X	X		Synonym = *Hymenophyllum recurvum*; delicate, epiphytic, epipetric, or occasionally terrestrial fern found in colonies on trees and old logs in wet, mossy forests (Palmer 2003)
Trichomanes alatum	Winged bristle fern	Puerto Rico	X	X				Shaded mossy trunks of tree ferns or moist rocks (Proctor 1989)
Trichomanes crispum	Crisped bristle fern	Puerto Rico			X			Epiphytic on trunks or rarely terrestrial (Lellinger 1989); widely scattered in wet situations at lower to rather high elevations in Puerto Rico (Liogier & Martorell 2000)
Trichomanes hymenophylloides	Thin-leaf bristle fern	Puerto Rico	X					Epiphytic on trunks and branches (Lellinger 1989)
Trichomanes krausii	Tree-moss bristle fern	Florida, Puerto Rico	X	X				"Epiphytic on tree trunks and roots, rarely on fallen trees or epipetric in limestone sinks" (Lellinger 1985)
Trichomanes lineolatum	Lined bristle fern	Florida, Puerto Rico		X				Farrar (1993a) reports this species from rock in limestone sinks; not considered established in North America according to Lellinger (1985)
Trichomanes membranaceum	Scale-edge bristle fern	Mississippi, Puerto Rico			X	X		Can be epiphytic, terrestrial, or grow on rocks (Farrar 1993a)
Trichomanes polypodioides	Jeweled bristle fern	Puerto Rico	X					Epiphytic on trunks, often of tree ferns (Lellinger 1989)

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			Tree	Rock	Tree/ terr.	Rock/ terr.		
Trichomanes punctatum	Dotted bristle fern	Florida, Puerto Rico, Virgin Islands	X	X				Epiphytic on trunks and roots of trees in limestone sinks or epipetric on limestone sink walls (Farrar 1993a)
Trichomanes radicans	Aerial-root bristle fern	Puerto Rico	X					Epiphyte on trunks of trees (Lellinger 1989)
Trichomanes rigidum	Stiff bristle fern	Puerto Rico					X	Terrestrial; not epiphytic (Lellinger 1989, Pacheco 1995)
Trichomanes robustum	Robust bristle fern	Puerto Rico			X			Mossy logs, tree trunks and deep humus on forest floor in wet montane forests (Proctor 1989)
Trichomanes scandens	Climbing bristle fern	Puerto Rico	X					Epiphyte on tree fern trunks in wet forest (Proctor 1989)
Liliaceae								
Astelia menziesiana	Pua'akuhinia	Hawaii			X			Terrestrial or epiphytic perennial herbs of mesic to wet forests and bogs (Wagner et al. 1999)
Loganiaceae								
Labordia hedyosmifolia	Bog labordia	Hawaii			X			Terrestrial of sometimes epiphytic woody vine-like shrubs of wet forests and bog margins (Wagner et al. 1999)
Lycopodiaceae								
Huperzia lucidula	Shining fir-moss	e USA				X		Synonym = *Lycopodum lucidulum*; Wagner and Beitel (1993) cite habitat as "terrestrial in shaded conifer forests and mixed hardwoods, rarely on rock on shady mossy acidic sandstone;" Lellinger (1985) describes as being terrestrial or epipetric

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			Tree	Rock	Tree/ terr.	Rock/ terr.		
Marantaceae								
Calathea lutea	Pampano	Puerto Rico					X	Acevedo-Rodriguez and Strong (2005) cite this species as being a "stout caulescent herb"; they do not consider the genus epiphytic; Croat (1978) cites as rarely in forests "except for tree-fall areas, occasional on creek beds and shoreline soil deposits" in Panama
Marcgraviaceae								
Marcgravia rectiflora	Bejuco de lira	Puerto Rico, Virgin Islands					X	Lianas with two morphological phases; juvenile plants climbing by adventitious roots; adult plants to 10 m long with scandent or pendulous branches; occurs in forests at low to moderate elevations (Acevedo-Rodriguez 2005)
Marcgravia sintenisii	Shingleplant	Puerto Rico					X	Juvenile plants climbing by adventitious roots; mature plants woody vines with scandent and pendulous branches; found in moist and wet forests at upper elevations (Acevedo-Rodriguez 2005)
Melastomataceae								
Medinilla cummingii	Chandelier tree	Hawaii	X					Exotic in Hawaii, native to the Philipines; grows as a scandent epiphytic shrub 1–2 (3) m high in mossy forests (Regalado 1995)
Medinilla venosa	Holdtight	Hawaii			X			Native to the Philippines, where it is cited as an epiphyte; introduced populations in Hawaii are shrubs or trees and not epiphytic (Wagner et al. 1999)
Moraceae								
Ficus aurea	Florida strangler fig	Florida			X			Hemi-epiphyte (germinates as an epiphyte, eventually becomes rooted and free-living, e.g. stranglers) (Holbrook and Putz 1996, Wunderlin 1997)
Ficus benghalensis	Indian banyan	Florida			X			Hemi-epiphyte; epiphytic as seedling and young plant, but ultimately descending to ground level and becoming rooted (Wunderlin 1997)

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			Tree	Rock	Tree/ terr.	Rock/ terr.		
Ficus benjamina	Weeping fig	Florida, Puerto Rico			X			Hemi-epiphytic tree that grows as an epiphyte as a seedling/sapling but eventually strangles the host plant to become rooted as an adult; native to tropical Asia (Harrison et al. 2003)
Ficus carica	Common fig	e and s USA, California, Puerto Rico					X	Shrub or small tree without adventitious roots; not hemi-epiphytic (Wunderlin 1997)
Ficus citrifolia	Wild banyantree	Florida, Puerto Rico, Virgin Islands			X			Terrestrial or strangling (epiphytic) tree or occasionally a liana (Acevedo-Rodriguez 2005)
Ficus elastica	Indian rubbertree	Florida, Puerto Rico			X			Epiphytic when young, becoming rooted in ground at maturity (Wunderlin 1997)
Ficus macrophylla	Moreton Bay fig	Australia			X			Cultivated in warm climates, native to eastern Australia; strangler species starting as an epiphyte when a seedling/sapling but becoming rooted with a banyan growth form at maturity (Hogan 2003)
Ficus microcarpa	Chinese banyan	Hawaii, Florida, Puerto Rico			X			Hemi-epiphytic, shrubby when young, becoming a tree at maturity (Wagner et al. 1999)
Ficus nota	Tibig	Hawaii					X	Cultivated and potentially invasive in Hawaii [though not cited as established by Wagner et al. (1999)]; native to the Philippines; Condit (1969) indicates that species is a tree or shrub without aerial roots (suggesting it is not hemi-epiphytic like many tropical *Ficus*) and grows along banks of streams and in forests; grows in variety of soils in areas with high humidity
Ficus platypoda	Australian fig	Australia		X				Native to Australia; described as lithophytic deciduous vines by Dixon (2003)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Ficus religiosa	Botree	Florida, Puerto Rico			X			Epiphytic as a seedling/sapling, with roots eventually penetrating inside the stem of its host tree and ultimately splitting the host's stem before the fig's own roots reach the ground (Galil 1984)
Ficus rubiginosa	Port Jackson fig	California, Hawaii			X			Native to Australia; hemi-epiphyte or terrestrial, becoming a tree at maturity (Gardner & Early 1996)
Ficus trigonata	Jaguey blanco	Puerto Rico, Virgin Islands			X			Hemi-ephiphyte that begins life as an epiphyte but eventually becomes rooted in ground as a mature tree (Holbrook & Putz 1996)
Ophioglossaceae								
Cheiroglossa palmata	Hand fern	Florida, Puerto Rico	X					Epiphyte among leaf bases on palmetto (*Serenoa repens*) trunks (Wagner & Wagner 1993)
Orchidaceae								
Anoectochilus sandvicensis	Hawaii jeweled orchid	Hawaii			X			Terrestrial, creeping, or decumbent forb "usually occurring in dense shade on wet, bryophyte-covered ground or on the lower parts of tree trunks, rarely epiphytic on tree ferns, in wet forest" (Wagner et al. 1999)
Bletia purpurea	Pine-pink	Florida			X	X		Typically terrestrial but can grow in humus over limestone or in swamps on logs, stumps, or the base of cypress trees (Ackerman 2002)
Dilomilis montana	Parrot-beak orchid	Puerto Rico			X			"Terrestrial or epiphytic orchid … commonly seen at high elevations. Plants thrive in virgin cloud and dwarf forests as well as in disturbed, open areas along trails and roadsides" (Ackerman et al. 1992)
Epidendrum secundum	Lopsided star orchid	Puerto Rico	X					"Grows epiphytically at middle to high elevations in moist and wet forest regions" (Ackerman et al. 1992)
Epidendrum x obrienianum	O'Brien's star orchid	Hawaii			X	X		Terrestrial or lithophytic perennial orchid or rarely at the base of trees or shrubs, usually on steep, rocky slopes or in dry habitats (Wagner et al. 1999)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Liparis hawaiensis	Hawaii wide-lip orchid	Hawaii			X			"Occurring on bryophyte-covered trees, under bushes, and on wet or sometimes seasonally wet, bare ground, in bogs, and mesic to wet forest" (Wagner et al. 1999)
Maxillaria crassifolia	Hidden orchid	Florida	X					Epiphytic on trees in Big Cypress Swamp in Florida (Rickett 1967)
Oncidium floridanum	Florida orchid	Florida			X			Chase (2002) considers *O. floridamum* to be a synonym of *Oncidium ensatum*; mostly epiphytic on bases and knees of cypress, but sometimes terrestrial in rich humus of hammocks (Chase 2002)
Scaphyglottis modesta	Malaysian orchid	Puerto Rico	X					Synonym = *Tetragamestus modestus*; epiphytic on trees (Moreira & dos Santos Isaias 2008)
Vanilla barbellata	Wormvine orchid	Florida, Puerto Rico, Virgin Islands					X	Herbaceous vine climbing by aerial roots from dry forests and coastal thickets (Acevedo-Rodriguez 2005)
Piperaceae								
Peperomia alterntfolta	Molokai peperomia	Hawaii	X	X				Occurs on rocks or epiphytic on tree trunks in mesic valleys (Wagner et al. 1999)
Peperomia cogniauxii	Yerba de guava falso	Puerto Rico	X					Occurs on trees and logs in mountain forests (Liogier and Martorell 2000)
Peperomia cooktana	Weak-stem peperomia	Hawaii			X	X		Epiphytic in trees, terrestrial on wet banks, or on rocks in wet forest to mesic shrubland (Wagner et al. 1999)
Peperomia degeneri	Kaluaaha Valley peperomia	Hawaii		X				Found in shaded cliffs, apparently known only from the type collection in Molokai (Wagner et al. 1999)
Peperomia distachya	Montane peperomia	Puerto Rico			X	X		On trees, rocks, and logs in mountain forests (Liogier and Martorell 2000)
Peperomia eekana	Mt. Eke peperomia	Hawaii			X			Epiphytic or occasionally terrestrial in wet forests (Wagner et al. 1999)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Peperomia ellipticibacca	Koolau Range peperomia	Hawaii			X			Epiphytic on trees or terrestrial in wet forests (Wagner et al. 1999)
Peperomia emarginella	Guadeloupe peperomia	Puerto Rico			X	X		On trees, rocks, and logs in wet mountain forests (Liogier & Martorell 2000)
Peperomia expallescens	Swamp peperomia	Hawaii			X			Epiphytic or terrestrial in wet forests (Wagner et al. 1999)
Peperomia glabella	Cypress peperomia	Florida, Puerto Rico			X			Epiphytic or terrestrial (Boufford 1997)
Peperomia globulanthera	Puu kuhui	Hawaii			X			Epiphytic on trees or terrestrial in wet forests (Wagner et al. 1999)
Peperomia hesperomannii	Single-nerve peperomia	Hawaii			X			Mostly terrestrial but occasionally epiphytic in wet forests in Hawaii (Wagner et al. 1999)
Peperomia hypoleuca	Thick-leaf peperomia	Hawaii			X			Terrestrial or epiphytic herb on trees in wet to rarely mesic forest (Wagner et al. 1999)
Peperomia kipahuluensis	Royal peperomia	Hawaii			X			Usually epiphytic in trees or in bryophyte mats, or sometimes terrestrial in wet forests and the edges of bogs (Wagner et al. 1999)
Peperomia latifolia	Hawaii peperomia	Hawaii				X		Grows on rocks or terrestrial in mesic valleys and mesic to wet forest (Wagner et al. 1999)
Peperomia macraeana	Pinni-nerve peperomia	Hawaii			X			Terrestrial or rarely epiphytic in wet forests of Hawaii (Wagner et al. 1999)
Peperomia magnolitfolia	Spoon-leaf peperomia	Florida, Puerto Rico, Virgin Islands			X			Terrestrial or epiphytic in hammock habitats (Boufford 1997)
Peperomia mauiensis	Maui peperomia	Hawaii	X	X				Found on moss-covered rocks or epiphytic on trees in mesic valleys (Wagner et al. 1999)

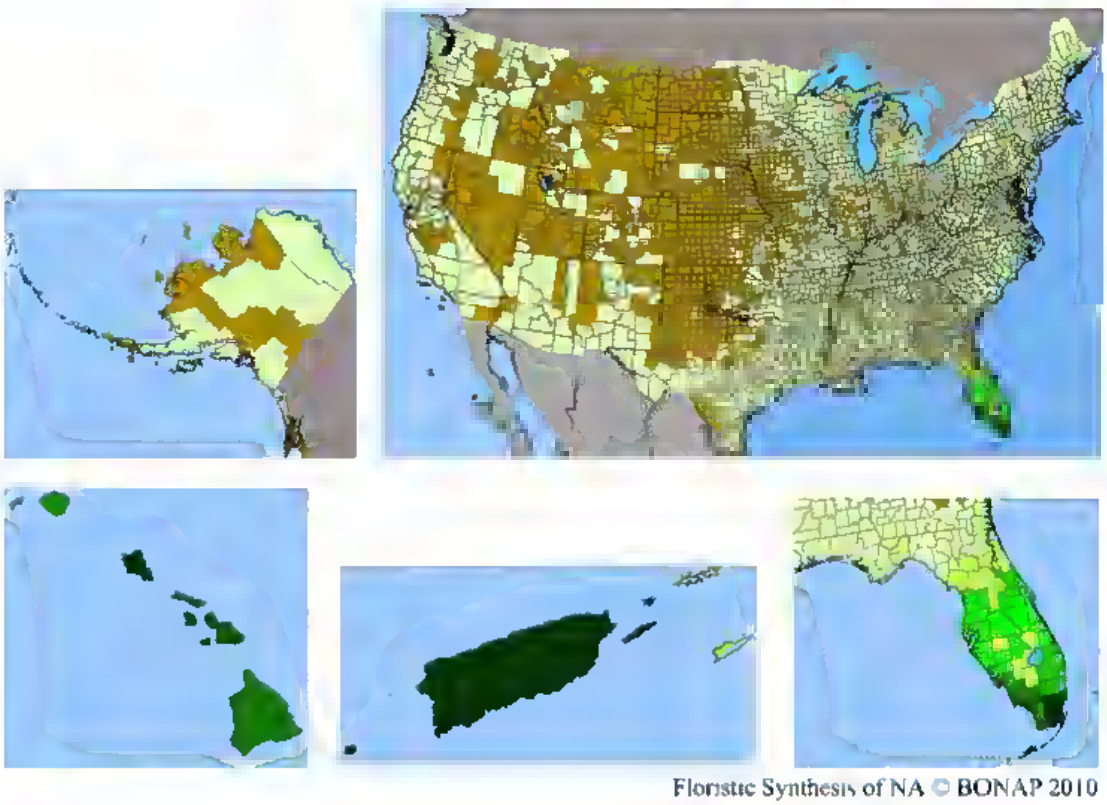
Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Peperomia membranacea	Woodland peperomia	Hawaii			X	X		Epiphytic on trees and rocks or terrestrial in mesic to wet forests (Wagner et al. 1999)
Peperomia oahuensis	Oahu peperomia	Hawaii	X					"Usually epiphytic" in mesic valleys (Wagner et al. 1999)
Peperomia obovatilimba	Graceful peperomia	Hawaii			X			Epiphytic or terrestrial on rotting logs or wet ground in wet forest (Wagner et al. 1999)
Peperomia quadrifolta	Four-leaf peperomia	Puerto Rico, Virgin Islands	X					On trees in woodlands of the western mountains of Puerto Rico (Liogier and Martorell 2000)
Peperomia remyi	Valley peperomia	Hawaii				X		Epiphytic on rocks or terrestrial in mesic valleys and mesic to wet forest (Wagner et al. 1999)
Peperomia robustior	Grand peperomia	Puerto Rico			X			Creeping on trees and logs in high-elevation forests in Puerto Rico (Liogier & Martorell 2000)
Peperomia sandwicensis	Single-spike peperomia	Hawaii				X		Epiphytic on moss-covered rocks or terrestrial in mesic valleys and wet forest (Wagner et al. 1999)
Peperomia tenella	Jayuya	Puerto Rico	X					On mossy trees in wet forests (Liogier & Martorell 2000)
Peperomia tetraphylla	Acorn peperomia	Hawaii, Puerto Rico			X	X		Grows on rocks, occasionally as an epiphyte on moss-covered trees, or in terrestrial habitats in shaded or open mesioc to wet forests, subalpine forests, and alpine desert (Wagner et al. 1999)
Polypodiaceae								
Campyloneurum angustifoltum	Narrow strap fern	Florida, Puerto Rico	X					Epiphytic on oaks, pond apples, magnolias, and other rough-barked trees in hammocks and swamps in the everglades (Nauman 1993a)
Campyloneurum latum	Bird-wing fern	Florida, Puerto Rico	X					Epiphytic in tropical hammocks; apparently extirpated in Florida (Nauman 1993a)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Campyloneurum phyllitidis	Long strap fern	Florida, Puerto Rico	X	X				Epiphytic in hammocks, sometimes on walls in limestone sinkholes (Nauman 1993a)
Lepisorus thunbergianus	Weeping fern	Hawaii			X	X		Epiphytic, epipetric, or terrestrial fern of dry to mesic or wet forests; native to eastern Asia, introduced in Hawaii (Palmer 2003)
Pecluma pectinata	Comb-leaf rockcap fern	Puerto Rico	X					Epiphytic in forests (Lellinger 1989)
Phlebodium aureum	Golden polypody	se USA, Hawaii, Puerto Rico, Virgin Islands	X					Epiphytic on variety of trees or on logs, dense piles of humus, or commonly among old leaf bases of Sabal palmetto (Nauman 1993c)
Phymatosorus grossus	Musk fern	Hawaii			X	X		Terrestrial or epipetric, or occasionally epiphytic, in disturbed areas and low-elevation forests (Palmer 2003)
Polypodium loriceum	Clambering polypody	Puerto Rico					X	Terrestrial fern with scandent rhizomes by aerial roots found in moist cordilleran forests (Acevedo-Rodriguez 2005)
Psilotaceae								
Psilotum complanatum	Flat fork fern	Hawaii			X			Epiphytic or terrestrial in rain forests (Lellinger 1989)
Psilotum nudum	Whisk fern	se North America, Arizona, Hawaii, Puerto Rico, Virgin Islands			X			Found "on trees and stumps, on humus hummocks, and palmetto root mounds in damp woods and swamps" (Lellinger 1985); considered ephiphytic or terrestrial (Thieret 1993)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Pteridaceae								
Pteris vittata	Ladder brake	Hawaii, California, se USA, Puerto Rico, Virgin Islands				X		Occurs on calcareous substrates, including buildings, sidewalks, and limestone ledges (Nauman 1993d); terrestrial or epipetric on limestone (Lellinger 1985)
Rubiaceae								
Schradera exotica	Yellowshrub	Puerto Rico			X			Hemi-epiphyte with juvenile phase attached to a host plant by adventitious roots, followed by an adult phase that develops into a woody vine with scandent and pendulous branches; found in moist and wet forests (Acevedo-Rodriguez 2005)
Schizaeaceae								
Schizaea poeppigiana	Epiphytic curly-grass fern	Puerto Rico				X		Grows in shade on serpentine (Liogier & Martorell 2000)
Selaginellaceae								
Selaginella krugii	Krug's spike-moss	Puerto Rico	X					Epiphyte endemic to Puerto Rico (Gould et al. 2006)
Selaginella tenella	Delicate spike-moss	Puerto Rico			X	X		Moist shaded mossy boulders or earthen banks and ledges near streams, or rarely an epiphyte on mossy tree trunks (Proctor 1989)
Solanaceae								
Solandra grandiflora	Showy chalicevine	ConnecticutPuerto Rico, Virgin Islands					X	Climbing vines native to Mexico and tropical America, often growing up trees near waterways (Hogan 2003)

Scientific name	Common name	Distribution	Obligate epiphyte		Facultative epiphyte		Not epi.	Comments
			Tree	Rock	Tree/ terr.	Rock/ terr.		
Thelypteridaceae								
Thelypteris deltoidea	Deltoid maiden fern	Puerto Rico, Virgin Islands			X			Terrestrial or rarely epiphytic on tree trunks on moist hillsides (Proctor 1989)
Violaceae								
Viola wailenalenae	Alakai swamp violet	Hawaii			X			Terrestrial or epiphytic subshrubs in wet forests and bog hummocks (Wagner et al. 1999)
Vittariaceae								
Anetium citrifolium	Tree-trunk fern	Puerto Rico	X					Epiphyte on tree trunks very near the ground or on stilt roots of the palm Scheelea zonensis (Croat 1978)
Antrophyum lanceolatum	Straight linear-leaf fern	Puerto Rico	X	X				Synonym = *Polytaenium feei*; epiphyte in dense, wet forests of tropical America (Gomez 1973); usually epiphytic but also sometimes on rocks (Nonato & Windisch 2004)
Vittaria lineata	Dixie shoestring fern	Florida, Georgia, Puerto Rico	X					Epiphytic on trunks of sabal palm (Sabal palmetto) in moist woods along streams (Farrar 1993b, Lellinger 1985)

Figure 1 Density gradient map of occurrences of epiphytes in the United States and its territories, according to BONAP (2010) The figure shows the richness coefficient of epiphytes Darker colors indicate greater richness Puerto Rico, Hawaii, Florida, and Alaska are not drawn to scale so that differences in richness will be more apparent



Legend	
Grey = outside study area	Lime green = 21–30 species
Dark tan = no species reported	Kelly green = 31–60 species
Light tan = 1–10 species	Dark green = 71–80 species
Chartreuse = 11–20 species	Black = 81–100 species

Mink, J.N., J.R. Singhurst, and W.C. Holmes. 2011. *Epilobium leptophyllum* (Onagraceae) in the Texas flora. Phytoneuron 2011-17: 1–3.

EPILOBIUM LEPTOPHYLLUM (ONAGRACEAE) IN THE TEXAS FLORA

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ABSTRACT

Epilobium leptophyllum is reported as new to Texas. This species was collected from Wheeler County, in the southern Great Plains of the Panhandle area of the state. A collection from Lake Meredith National Recreation Area in Potter County also is documented here.

KEY WORDS: *Epilobium*, Onagraceae, Lake Meredith National Recreation Area, Great Plains, Texas

Recent field study conducted in Wheeler County, on the eastern edge of the Texas Panhandle, has resulted in the discovery discussed below. The vegetation of Wheeler County is part of the mixed grass prairie of the Great Plains. In Texas this vegetational region is recognized as the Rolling Plains.

***Epilobium leptophyllum* Raf.** (Onagraceae). Until now, only two species of *Epilobium* were known to occur in Texas: *E. ciliatum* Raf. and *E. coloratum* Biehler. The former occurs in the southern portion of the trans-Pecos region, while the latter is known from the Rolling Plains of the Panhandle (Turner et al. 2003). A third species, *E. leptophyllum* Raf., is documented here.

Voucher specimen: **TEXAS**. Wheeler Co.: Britt Ranch, 2.3 miles N of jct. of Tex. Hwy 152 and FM 592, from entrance of ranch, ca. 5.1 mi. NNE to NW headwaters of Murtaugh Creek, 27 Jul 2010, *Holmes*, *Singhurst,* and *Mink 15094* (BAYLU). Fig. 1.

Epilobium leptophyllum was discovered in a marshy meadow near the headwater springs of the Northwest Fork of Murtaugh Creek, a broad marshy stream valley that flows south into Sweetwater Creek, a tributary of the North Fork of the Red River. Specimens of *Epilobium leptophyllum* were uncommon and infrequently encountered in immediate proximity to fen margins. The aquatic systems in this area, which flow through hills composed of loose and deep sands, support a wide range of more eastern herbaceous species such as *Eupatorium perfoliatum*, *Euthamia gymnospermoides*, *Carex annectens*, *Carex stricta*, *C. triangularis*, *Apios americana*, and *Agrimonia parviflora*. Other unusual species of the area were *Utricularia macrorhiza*, *Myriophyllum sibiricum*, and *Verbena hastata*. The most abundant herbaceous plants growing in association with *E. leptophyllum* included *Eleocharis rostellata*, *Schoenoplectus pungens*, *Equisetum laevigatum*, and

Typha latifolia. The only woody plant (shrub) of abundance was *Baccharis salicina*, which occurred along the periphery of surface water areas and marsh inclines.

The *Epilobium* plants were erect, 60–90 cm tall; the leaves strigillose-pubescent, 7 cm long, and about 2 mm wide with entire-revolute margins. The flowers were white.

The known occurrence nearest to the Wheeler County record of *Epilobium leptophyllum* is in Roger Mills Co., Oklahoma, which is approximately 24 km to the east (*Freeman 18359 & C.A. Morse*, KANU). An adjacent distributional record northward is at least 176 km in Meade Co., Kansas (McGregor & Barkley 1977). This Wheeler County locality is probably the southernmost known for *E. leptophyllum*.

In researching voucher distribution of *Epilobium leptophyllum*, the authors became aware of the existence of a previously unpublished collection in Texas (Nesom & O'Kennon 2005), from a locality about 140 km to the west of the Wheeler Co. record, which is documented here.

TEXAS. Potter Co.: Lake Meredith Natl. Recreation Area, Chicken Creek area, vicinity of access road ca. 1 mile westward along creek to confluence with Canadian River; N35° 28' 29", W101° 45' 30", immediate sandy terraces and marshy margins of Chicken Creek and adjacent riparian woods, ca. 3000-3010 ft elev.; *Epilobium leptophyllum* rare, in muck at edge of *Typha* population, 22 Sep 2002, *Nesom & O'Kennon 919* (BRIT).

Texas collections of *Epilobium leptophyllum* represent significant southern distributional extensions for the species. The PLANTS database (USDA, NRCS 2011) lists *E. leptophyllum* for New Mexico, citing Martin & Hutchins (1981) and a specimen from NMC, but SEINET (2011) does not include specimen documentation for the species in New Mexico from ENMU, NMC, NMCR, RM, or UNM. Allred (2009) appears to interpret the citation of *E. lineare* Muhl. by Wooton & Standley (1915; *Wooton 661* from the White Mountains) as being correctly identified as *E. leptophyllum*. In any case, southern distributional limits for *E. leptophyllum* can be reliably based on the collections from Potter and Wheeler counties, Texas.

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Figure 1. *Epilobium leptophyllum* prior to collection (*Holmes, Singhurst, & Mink 15094*, BAYLU). Photograph by Jason Singhurst.

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NOTES ON THE FLORA OF TEXAS, ARKANSAS, AND LOUISIANA, WITH ADDITIONS AND OTHER RECORDS. IV

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ABSTRACT

The following taxa are documented new to Texas: *Arivela viscosa*, *Euphorbia graminea*, *Indigofera hirsuta*, and *Muhlenbergia sericea*. *Eleocharis baldwinii* is reported new to Arkansas and *Setaria corrugata* is reported new to Louisiana. New collection records for Texas are provided for *Aeschynomene viscidula*, *Bassia scoparia*, *Bromus lanceolatus*, *Canavalia rosea*, *Carex decomposita*, *Carex kraliana*, *Carex planostachya*, *Ceratophyllum echinatum*, *Crepis zacintha*, *Desmodium incanum*, *Eleocharis baldwinii*, *Eleocharis mutata*, *Eleocharis wolfii*, *Galium triflorum*, *Glyceria striata*, *Ludwigia erecta*, *Mirabilis austrotexana*, *Mirabilis gigantea*, *Oxycaryum cubense*, *Paspalum acuminatum*, *Paspalum conjugatum*, *Ruta chalapensis*, *Setaria corrugata*, *Tradescantia fluminensis*, *Tradescantia subacaulis*, *Tridax procumbens*, *Utricularia purpurea*, *Wahlenbergia marginata*, and *Zeuxine strateumatica*.

Floristic work in the Houston area and east Texas counties, coupled with plants sent to the SBSC herbarium for identification and/or deposit, has revealed four species new to Texas plus one species new to Arkansas and one new to Louisiana, as well as new records for other Texas counties. Herbarium acronyms are those in Holmgren et al. (1990). Unless otherwise indicated, all cited collections are in the Spring Branch Science Center Herbarium (SBSC), Houston, Texas.

ASTERACEAE

Crepis zacintha (L.) Loisel. The first known collection for the United States was made in April 1992 in Waller County, Texas (Gandhi & Brown 1993). A second collection has now come to light, also from Texas.

Voucher: **Henderson Co.**: Open sandy field ca. 100 meters SW of Purtis Creek State Park Headquarters Building along W side of park road entrance, 29 Apr 2009, *Eric Keith 969* (SBSC).

Tridax procumbens L. Brown and Elsik (2002) reported this exotic composite new to Texas from Hidalgo County. It is now present in adjacent Starr County, where it was a sidewalk weed in the Roma historical district in downtown Roma.

Voucher: **Starr Co.**: Frequent sidewalk weed in the Roma historical district near the Roma Bluffs, a World Birding site, 17 Mar 2011, *Larry E. Brown 36220* and family (SBSC).

This pantropical weed of American origin is also present in Florida, where it occurs from Volusia County south to the keys of Monroe County. There is an isolated record for Leon County adjacent to the state of Georgia (Wunderlin & Hansen 2010).

CAMPANULACEAE

Wahlenbergia marginata (Thunb.) A. DC. Turner et al. (2003) mapped this Asian native in Hardin, Jasper, and Newton counties in extreme east Texas. Recent collections to the west in Harris and Montgomery counties are vouchered here.

Vouchers: **Harris Co.**: Jesse Jones County Park along Spring Creek at end of Kenswick Drive N off of Hwy 1960 W of Humble, along side of the new drainage ditch, 21 Apr 2011, *Paul V. Roling s.n.* (SBSC). **Montgomery Co.**: Tanyard Road ca 2 miles E of junction with Rt 1097, NE of Willis, 17 Apr 2003, *Daniel P. Johnson 1602* (SBSC); on a high road cut through an outcrop along County Line Road E of the village of Willis and just E of intersection with Rose Road, 30°23 4' N and 95°29 0' W, 27 Aug 2008, *Larry E. Brown 33950* (SBSC), off of McCory Rd ca 100 yards S of Tanyard Rd all E of the village of Willis, 30°27.02' N and 9°522 37' W, Montgomery Co., Key Map 90 block Y, 12 June 2010, *Larry E. Brown 35512* (SBSC).

The Plants Database (USDA, NRCS 2009.) mapped it in eleven southeastern states from North Carolina and Florida west to Texas. It appears to be moving westward in Texas.

CERATOPHYLLACEAE

Ceratophyllum echinatum A. Gray Turner et al. (2003) mapped this submerged aquatic only in Bowie County. We voucher two collections far to the south in Harris County.

Vouchers: **Harris Co.**: Jesse Jones County Park N off of Hwy 1960 west of the village of Humble and at the end of Kenswick Drive, in swamp with boardwalk, 26 Oct 2010, *Paul Roling s.n.* with Anita Howlett (SBSC), common in small cypress swamp in Jesse Jones County Park, between Spring Creek and Hwy 1960 W of Humble, 22 May 1985, *Larry E. Brown 8856* (SBSC).

CHENOPODIACEAE

Bassia scoparia (L.) Schrad. Turner et al. (2003) mapped this species as *Kochia scoparia* (L.) Schrad., largely in the northern Panhandle and the trans-Pecos regions of Texas and only in six scattered counties to the east of these two regions. Their most eastern record was Brazos County. We report collections from two additional eastern counties, with the most eastern record now in Chambers County.

Vouchers: **Chambers Co.**: salty, compacted dredged material on islands named Mid-Bay beneficial use cells in Galveston Bay, June 2007, *Jamie Schubert s.n.* (SBSC). **McLennan Co.**: on a dry soil in the Heart of Texas fairgrounds in Waco, Spring 2005, *Paul Roling s.n.* (SBSC).

CLEOMACEAE

Arivela viscosa (L.) Raf. This native of southeast Asia was reported from Florida, Georgia, Louisiana, and South Carolina with reports of non-persistent ballast plants in New Jersey and Pennsylvania (Tucker 2010). It was previously in the genus *Cleome* and mapped as C. *viscosa* L. in the family Capparidaceae from only Natchitoches Parish, Louisiana (Thomas & Allen 1996; based upon the report by Holmes 1981). This is the first report of this species in Texas.

Vouchers: **Harris Co.**: Jesse Jones County Park N of Hwy 1960 west of Humble, enter park through the Kenswick subdivision and it is in the bottomland of Spring Creek at end of Kenswick Road, NE corner of bridge, August 2005, *Paul V. Roling s.n.* (SBSC), same site, 10 July 2006, *Paul V. Roling s.n.* (SBSC).

COMMELINACEAE

Tradescantia fluminensis Vell. Diggs et al. (2006) reported this tropical American native in Dallas, San Jacinto, Nacogdoches, Brazos, and Smith counties, but they did not map it in Brazos and Smith counties because they noted that records for those two counties were on the Digital Flora of Texas Herbarium Specimen Brower (2002) and not seen by them. We voucher the San Jacinto County specimen and add records for Harris and Montgomery counties. This species was not included in Turner et al. (2003).

Voucher: **San Jacinto Co.** in a ravine about 0.5 mile W of downtown Coldspring, with *E. cyathophora* and southern shield fern, 5 Mar 2000, *Eric Keith s.n.* (SBSC). **Harris Co.** Jesse Jones County Park at end of Kenswick Drive which exits to the north off of FM 1960 west of the city of Humble, fall 2008, *Paul Roling s.n.* (SBSC), Houston in the Sims Woods Conservation area along Sims Bayou W of the Telephone Road bridge over the Bayou. Key Map 535s, 18 Apr 1999, *Larry E. Brown 22988* (SBSC). **Montgomery Co.** along trails in the George Mitchell Park in the Woodlands Development (exit I-45 onto the Woodlands Parkway and then onto Gosling to the south, next exit Gosling onto Flintridge going west — the Park entrance is on the S side of Flintridge), Harris Co. Key Map 250G, 26 April 2009, *Larry E. Brown 34515* with Native Plant Society (SBSC).

Tradescantia subacaulis Bush Maps for Texas spiderwort species in Turner (2006, for the entire state) and Diggs et al. (2006, for east Texas) are similar except Turner mapped *T. subacaulis* in Newton County and Diggs et al. did not. We voucher a Newton County collection.

Voucher: **Newton Co.** on a sandhill in the vicinity of the village of Newton, 17 Mar 2001, *Larry E. Brown 25024* (SBSC).

CYPERACEAE

Carex decomposita Muhl. Turner et al. (2003) mapped this sedge in Marion and Wood counties. Jones (2006) mapped the additional counties of Jasper, Liberty, and San Jacinto. We report one other county.

Voucher: **Harris Co.:** Pundt Park in water of north lake, new county park at end of Spring Cypress Rd., E off of Aldine-Westfield Rd., Key Map 293 block Q, 2 May 2010, *P. Roling s.n.* (SBSC).

Carex kraliana Naczi & Bryson Turner et al. (2003) did not map this sedge in Texas. Jones in Diggs et al. (2006) reported it in Marion, Sabine, and Tyler counties. One new county is reported below.

Voucher: **Liberty Co.:** on an elevated area in a bottomland near Long John Creek, N of Dayton between Hwys 321 and 1008, Mar 2009, *Arthur Perkins s.n.* (SBSC).

Carex planostachys Kunze. This sedge of alkaline soils extends east from the trans-Pecos area of Texas to Grimes County. The collection cited here extends the distribution one county to the east — Montgomery County has small, isolated areas of alkaline soils.
Voucher: **Montgomery Co.**: in a pasture 1 mile S of the village of Montgomery and 100 meters W of FM 149, 2 Apr 1999, *Eric Keith s.n.* (SBSC).

Carex typhina Michx. Turner et al. (2003) and Jones in Diggs et al. (2006) mapped this northern sedge clustered in seven northeast Texas counties. Jones in Diggs et al.(2006) mapped it south to Shelby and Jasper counties. We voucher a recent collection from Liberty County.

Voucher: **Liberty Co.**: Menard Creek Unit of the Big Thicket National Preserve, on slopes and slope edges of Menard Creek off of the road to Birdwatchers Trail (the road to the trail exits Hwy 2610 at a grocery store just S of the bridge over Menard Creek and north of Romayor), 30°29'20" N, 94°50'05" W at vehicle on road to parking lot for trail, 17 May 2008, *Larry E. Brown 33518* with Sam Harper (SBSC).

Eleocharis baldwinii (Torr.) Chapman. Lipscomb (1978) reported this small sedge from Caddo Lake State Park in Harrison County based upon *Fleetwood 1174* (SMU). Turner et al. (2003) mapped it in six counties in east Texas extending from Sabine County westward to Bastrop County. We report it in three new counties: Harris, Hardin, and Montgomery.

Vouchers: **Harris Co.**: in the new county park, Pundt Park, along Spring Creek at end of Spring Creek Drive east of intersection with Aldine Westfield Road, near 30°05.0' N, 95°22.5' W, 31 Aug 2009, *P.V. Roling s.n.* (SBSC). **Hardin Co.**: common in water at the Hwy 770 bridge over Little Pine Island Bayou east of Saratoga, Lance Rosier Unit of the Big Thicket National Preserve, near 30°16.96' N, 94°32.16' W, *Larry E. Brown 30387*, (TAES), *30163* (TAES). **Montgomery Co.**: in a pond in a housing tract in Pinehurt which is off of Hwy 1774 at intersection with Hwy 149, N of Tomball, 11 Aug 2000, *Charles Peterson 1654* (SBSC).

This species has not been reported in Arkansas (Smith 1988, 1994). SBSC was given an unidentified collection of *Eleocharis* from Arkansas that we later identified as this species.

Voucher: **Arkansas. Ouachita Co.**: Along north bank of Smackover Creek at Ark. 7 bridge at the Union County line S of Camden, Sec. 30, T15S, R16W, 8 Oct 2000, *R.D. Thomas and C. Doffitt 167,766 and CD-1062* (NLU, SBSC).

Eleocharis mutata (L.) Roem & Schult. Rosen and Jones (2004) reported this sedge new to North America based upon a 2002 Brazoria County collection and a 1941 Goliad County collection at TAES annotated as *E. acutangula* (Roxb.) Schult. We report an additional specimen from Galveston County.

Voucher: **Galveston Co.**: along trails and off trails in the Wetland Center of Texas A&M University across Pelican Road from the main campus on Pelican Island, 29°18' N, 94°57' W, 7 Jan 2008, *Larry E. Brown 33199* (SBSC, TAES).

Eleocharis wolfii (A. Gray) A. Gray ex Britton. Turner et al. (2003) did not map this sedge in Texas. Diggs et al. (2006) however, mapped it in the northeastern counties Bowie and Morris as well as in Jefferson, Burleson, and Burnett counties. We report two additional counties — Brazoria and Harris.

Vouchers: **Brazoria Co.**: on the Parker Tract of the San Bernard National Wildlife Refuge, approx. 4.3 air miles SW of the intersection of Hwys 646 and 1745 in Santa Fe, in fields with occasional small trees in mesic forest, GPS - UTM 15 290783E 32465906N (NAD 83), 10 May 2005, *Larry E. Brown 30490* with David Rosen (SBSC). **Harris Co.**: in a field at the MRA land fill site, SE side of NASA Rt 1 behind Fiesta

Supermarket which is near intersection with Hwy I-45 south of Houston, Apr 1991, *Katie Northrup s.n.* (SBSC)

It was not rare in the Parker Tract fields. Diggs et al. (2006) considered it of possible conservation concern in Texas because it is rare in a number of states.

Oxycaryum cubense (Poepp. & Kunth) Lye Correll and Johnston (1979) reported this sedge, as *Scirpus cubensis*, very rare and known in the state only from a 1958 collection from Eagle Nest Lake in Brazoria County. At SBSC there are two recent Brazoria County collections from the Bird Pond tract of the San Bernard National Wildlife Refuge and one from Brazos Bend State Park in Fort Bend County. Turner et al. (2003) mapped it in Brazoria and Fort Bend counties. We report a recent collection from Orange County.

Voucher **Orange Co.** Beaumont Unit of the Big Thicket National Preserve, common at edge of a bald cypress swamp in and adjacent to a pipeline right of way that extends eastward from Four Oaks Ranch Road, all S of the intersection with Hwy 1139 N of Vidor, 30°09.49′ N, 94°06.80′ W, at car parked on Four Oaks Ranch Road across from the Salt Water Barrier on the Neches River, 21 Nov 2010, *Larry E. Brown 36044* with Shawn Harper (SBSC, TAES)

EUPHORBIACEAE

Euphorbia (Agaloma) graminea Jacq. This herb, native to tropical America, is mapped across a large part of Florida, extending from Escambia County in the panhandle eastward and southward to the Florida keys (Wunderlin & Hansen 2010). The following are five collections of it from three Texas counties.

Vouchers **Fort Bend Co.** in a flower planting at the Fort Bend County library (Sugarland Branch) in the city of Sugarland, located at 550 Eldridge at intersection with 7th Street, 11 Oct 2009, *Jed Aplaca 729* (SBSC). **Hardin Co.** in flower pots in the parking area of the Lumberton Inn Motel off of Hwy 69/287 on N edge of Lumberton across Hwy from a Wal-Mart Store,16 Jun 2006, *Larry E. Brown 30331* (SBSC) **Harris Co.** on grounds of the Sunnyside storefront police station at 3511 Reed Road in Houston, 20 Jul 2009, *Jed Aplaca 678* (SBSC); in a flower bed in the homestead farm area of the Jesse Jones County Park, which is N of Hwy 1960 to the W of the city of Humble, at the end of Kenswick Drive N of intersection with Hwy 1960, Harris County Key Map 335 block J, 25 Nov 2006, *P.V. Roling s.n.* (SBSC); a contaminate in potted plants at the home of Linda Knowles in Houston, Nov 2008, *L. Knowles s.n.* (SBSC)

Ward and Housel (2007) noted that this plant has rapidly expanded its range through association with greenhouse detritus and landscape plantings. They also provided characters to distinguish this species from the similar *E. oerstediana* (Klotzsch & Garcke) Boiss. *Euphorbia graminea* also is included in the key to the Florida species of *Euphorbia* in Wunderlin and Hansen (2003). The species likely arrived in Texas as a nursery stock containment.

FABACEAE

Aeschynomene viscidula Michx. Turner et al. (2003) mapped this joint-vetch from Calhoun County south along the coastal counties to Kennedy County. They also mapped it in four counties in the southeast edge of the Edwards Plateau. We report a collection of it from Harris County apparently somewhat separated from those mapped.

Voucher **Harris Co.** Houston, in a water area in the Holmes Road land fill site S of Holmes Rd., a few hundred feet W of the intersection with Kirby Road, 10 Nov 1998, *Larry E. Brown 22826* (SBSC)

Canavalia rosea (Sw.) DC. Lehman et al. (2005) reported this sea bean from Yarborough Pass on Padre Island in Kenedy County. However, they reported that it had not been seen in recent years.

Richardson (1995) reported it on loose sand near the coast in Cameron County. Turner et al. (2003) mapped sites, apparently on Padre Island, in Nueces, Kenedy, and Cameron counties. We report a recent collection from Galveston County.

Voucher: **Galveston Co.**: Galveston Island, sand dune off Seawall Blvd across from Hotel Galvez, 28 Nov 2002, *Eric L. Keith 344* (SBSC).

Correll & Johnston (1979) indicated that *Canavalia rosea* is rare in Texas and perhaps not persistent. We have not found it again on Galveston Island, and it probably should be regarded as a species that is infrequently wafted into Texas from the tropics. Tom Patterson, however, has observed the following (see Nesom et al. 2010): "*Canavalia rosea* was collected from Padre Island in Kenedy Co. by Hildebrand in 1955. Turner collected it in Cameron Co. near the ferry landing in 1959. I visited the ferry landing site in 1995 and found *C. rosea* still persisting. Since then *C. rosea* is becoming a dominant dune plant in the town of South Padre Island."

Desmodium incanum DC. Correll and Johnston (1979) reported this introduced legume under the name *D. canum* (Gmel.) Schinz & Thell., known at the time only from DeWitt County. Isley (1998) and Turner et al. (2003) mapped it as *D. incanum* in Brazoria, San Patricio, and DeWitt counties. We report a collection from one additional county.

Voucher: **Harris Co.**: in a flower pot with other plants at the home of Linda Knowles, who indicated she transplanted it to the pot from somewhere in Houston, 27 Sep 2009, *Larry E. Brown 35040* (SBSC).

Indigofera hirsuta L. Hairy indigo is native to the Old Word tropics (Isley 1998) and is mapped in Alabama, Florida, Georgia, and South Carolina (USDA, NRCS 2009). The voucher is the first report for Texas.

Voucher: **Harris Co.**: on the esplanade on South Wayside Street near intersection with Wheeler Avenue in Houston, 29 Jul 2009, *Jed Aplaca s.n.* (SBSC).

LENTIBULARIACEAE

Utricularia purpurea Walter Turner et al. (2003) mapped this uncommon purple-flowered aquatic in Chambers and Hardin counties. We report a recent collection from San Jacinto County.

Vouchers: **San Jacinto Co.**: in a wetland at the Montgomery and San Jacinto County border at N edge of Hwy 105 between Cleveland and the bridge over Peach Creek, 15 Jun 2009, *Paul Roling s.n.* with Dale Kruse (SBSC).

MYRSINACEAE

Ardisia crenata Sims Turner et al. (3003) mapped this non-native only from Hardin County (based onn the report by Singhurst et al. 1997). We report another escaped population in a Houston park.

Voucher: **Harris Co.**: on slope of a small gully in the Houston Arboretum and Nature Center in Memorial Park (Memorial Park is entered off of Woodway Drive just east of the intersection with I-610 in Houston), deep in woods and not near any house or garden. 29°39.49' N, 95°52.52' W, at entrance to Arboretum, 14 Jan 2010, *Mary H. Pritchett and Russell Jeffers s.n.* (SBSC).

NYCTAGINACEAE

Mirabilis austrotexana B.L. Turner Turner et al. (2003) mapped this tall four o'clock of sandy soils from Lavaca and Bexar counties at the northernmost range south to Cameron County in extreme south Texas. We collected four specimens of it from the same site in Austin County and one specimen from Waller County. Our first specimen was collected on 29 October 1983 in Austin

County and at that time we identified it as *M. collina* Shinners. We were not comfortable with this identification and later corrected it with Turner's treatment (1993).

Vouchers: **Austin Co.** on deep sands on the W side of the Brazos River along the north service road of I-10 bridge over the river, 29°46 2' N, 96°02 5 W, 16 Oct 2008, *Larry E. Brown 34129* (SBSC). **Waller Co.** on deep sands adjacent to Clear Creek at the Hwy 1433 bridge, ca 1 mi E of Hempstead, 20 May 1997, *Larry E. Brown 20435* (SBSC).

Mirabilis gigantea (Standl.) Shinners Turner et al. (2003) mapped this tall species of sandy soils largely from Grayson County south to McLennan County with isolated sites in Walker and Washington counties. We add Waller County to the known distribution.

Voucher: **Waller Co.** in field in the so-called Tucker Prairie of the Katy Prairie Nature Preserve, on the Waller County Key 362 in blocks H and M, 29°56' N, 95°53' W, 30 Jul 2008, *Larry E. Brown 33863* (SBSC).

ONAGRACEAE

Ludwigia erecta (L.) H. Hara Turner et al. (2003) mapped this species in Brazoria County. The Plants Database (USDA, NRCS 2009) mapped this water-primrose only in Alabama and Florida. We voucher two recent Harris County collections.

Vouchers: **Harris Co.** tall yellow flowered herb at edge of small stream on service road of I-10 just E of the Mason Rd overpass of I-10 between Katy and Houston, 24 Oct 1992, *Larry E. Brown 16726* (SBSC), on sandy beach in Jesse Jones County Park along Spring Creek at end of Kenswick Drive N off of Hwy 1960 W of Humble, 20 Oct 2009, *Paul Roling s.n.* (SBSC).

Wunderlin and Hansen (2003) separated *Ludwigia erecta* from *L. octovalvis* (Jacq.) Raven by 4–5 mm long petals and 3–4 mm long calyx lobes vs. (10–)15–30 mm long petals and (5–)10–15 mm long calyx lobes in *L. octovalvis*. We have also noted that they differ in seed shape — i.e., seeds narrow, ca 0.5 mm wide and longer than wide in *L. erecta* vs. ca 1 mm wide and ca 1 mm long and thus more or less square in *L. octovalvis*. Larry Brown identified his collection as *L. octovalvis* until the differences in seed traits were noted. The first report for the species in Texas was by Turner et al. (2003), but it was undocumented.

ORCHIDACEAE

Zeuxine strateumatica (L.) Schlechter Turner et al. (2003) mapped this non-native orchid in Harris and Montgomery counties. We report recent collections in Brazoria, Fort Bend, and Galveston counties. Brown and Gandhi (1989) reported it from Kingwood in Montgomery County, but this was an error, since Kingwood is in Harris County.

Voucher: **Brazoria Co.** along the roadside of FM 2004 ca 0.4 miles N of Chocolate Bayou, 31 Jan 2007, *John Ward s.n.* (SBSC). **Fort Bend Co.** by a pool in the Sugar Grove Community near the city of Sugarland, growing in mulch under oleander shrubs, Mar 16, 2007, *Jed Aplaca 356* (SBSC). **Galveston Co.** in a yard at South Shore Blvd. in the village of League City, 2 Feb 2007, *Vimlya Chopa s.n.* (SBSC).

POACEAE

Bromus lanceolatus Roth Gould (1975) reported this introduced grass as *Bromus macrostachys* Desf., present in Texas only in Brazos County near College Station. Turner et al. (2003) mapped it in Brazos and Washington counties. We report recent collections from Austin and Llano counties.

Vouchers: **Austin Co.** Hwy 36 and Loop 497, N of Bellville, disturbed roadside and adjacent fields, associated
with *Nassella, Lolium perenne, Dichanthelium sphaerocarpon,* and *Sorghum halepense*, sandy soils, N

30°003'39.3" and W 96°20'10.7", 19 Apr 2002, *S.L. Hatch 8035* (TAES). **Llano Co.:** Shady stream bank on sandy clay in NW portion of Enchanted Rock State Park, WGS 84 98.837638°E, 11 May 2008, *Eric L. Keith 940* (SBSC).

Glyceria striata (Lam.) Hitchc. Turner et al. (2003) mapped this grass, which is more frequent in the northern regions of the country, from far west Texas (probably from Guadalupe National Park in Culbertson County), from Lamar County (adjacent to Oklahoma), and in Blanco, Gillespie, McLennan, and Travis counties (central Texas). We report a collection of it from Hardin County in the Pineywoods of east Texas.

Voucher: **Hardin Co.:** in the Jack Gore Baygall Unit of the Big Thicket National Preserve, along the Wagon Road Trail, which is off of a pipeline right-of-way that is entered from the only section of the Unit adjacent to Hwy 2927, N of Silsbee, 30°27.6' N, 94°10.6' W, at entrance to Unit along Hwy 2927, 29 April 2009, *Larry E. Brown 3455* (TAES).

In Louisiana this grass does not extend as far south as in Texas, for it is present in only two parishes, Lincoln and Morehouse, near Arkansas (Allen et al. 2004).

Muhlenbergia sericea (Michx.) P.M. Peterson Charlotte Reeder in Gould (1975) reported this species, as *M. filipes* M.A. Curtis, in Texas region 2. At TAES we could find no Texas collections of it as *M. filipes* or as *M. capillaris* (Lam.) Trin. var. *filipes* (M.A. Curtis) Chapm. ex Beal. Correll and Johnston (1979) did not distinguish it varietally from *M. capillaris*. It was not included as a variety or species in Turner et al (2003) and not mapped by Peterson (2003) in Texas. It is purchased and cultivated under the name "purple muhly" (Peterson 2003), and in the Houston area, it is appearing more and more frequently in landscape plantings. How the voucher collection arrived in Jesse Jones County Park is not known, as there apparently are no cultivated plants in this area.

Voucher: **Harris Co.:** in Jesse Jones County Park, on top edge of a new drainage ditch, on W side of ditch halfway between bridge and south fence (park is along Spring Creek at end of Kenswick Drive, N off of Hwy 1960 W of Humble), 30°01.4' N, 95°17.6' W, at entrance gate to park, 18 Oct 2009, *Paul V. Roling s.n.* (SBSC).

In Louisiana, Allen et al. (2004) reported this grass at species rank, i.e., *M. sericea*, as rare on sandy coastal islands in St. Bernard and Terrebonne parishes. In Florida, Wunderland and Hansen (2003) reported it at varietal rank, i.e., *M. capillaris* var. *filipes*, as frequent on beaches, dunes, and wet flatwoods.

Paspalum acuminatum Raddi Gould (1975) saw no Texas collections. Turner et al. (2003) mapped it in the coastal counties of Chambers, Brazoria, Calhoun, Refugio, Aransas, and Cameron. Diggs et al. (2006) reported one record for Harris County, which is the first voucher listed below. We cite additional collections for Harris County and add Waller County to its distribution.

Vouchers: **Harris Co.:** in a wet prairie pot hole, N of Pine Forest Drive just W of intersection with Clay Road, W of Bear Creek Park in the Addicks Reservoir, W of Houston, 2 Oct 1998, *Larry E. Brown 22748* (SBSC); in water in the Sheldon Reservoir State Park off of highway 90 to the east of Houston, 30 May 2008, *Paul Roling s.n.* (SBSC), in water along Steinhagen Rd S of intersection with Grant Road and N of Little Cypress Creek, in village of Cypress N of Hwy 290, 30.013873° N, 95.684861° W, 3 Nov 2010, *Larry E. Brown 36064* (SBSC). **Waller Co.:** along Hebert Rd in a wet area on N side of unpaved section of road between paved section at Pattison Road and 1st curve going east, 29°56.01' N, 95°53.78' W, 6 Oct 2010, *Larry E. Brown 35874* (SBSC), in a prairie pot hole surrounded by sandy soil in the Tucker property of the Katy Prairie Conservancy, site located off of Berry Road N of the Katy Prairie field office, 29°57.74' N, 95°54.41' W, at locked gate to Tucker property, *Larry E. Brown 35536* with Paul Roling and other members of the Native Plant Society (SBSC).

This grass somewhat resembles *Urochloa platyphylla* and can be confused with it as Larry Brown did with a Big Thicket Beaumont Unit collection from Orange County, which he mistakenly identified in the field as *Paspalum acuminatum*.

Paspalum conjugatum P.J. Bergius Gould (1975) reported collections only from Cameron County. Turner et al. (2003) mapped collections in Cameron and Hardin counties. Diggs et al. (2006) mapped collections in Liberty and Cameron counties and indicated that the Hardin County record in Turner et al. (2003) was from a cultivated plant. All SBSC collections of it are cited below, adding records from Brazoria and Orange counties.

Vouchers: **Brazoria Co.** in the Bird Pond Unit of the Brazoria County National Wildlife Refuge complex, off of FM 524 south of the intersection with FM 1301, Brazoria County Key Map 820 blocks Y and Z, 29°08'13" N and 95°47'43" W, 21 Oct 2001, *Larry E. Brown 26399a* (SBSC), in the San Bernard NWR, Dance Bayou Tract, E of FM 524 and just S of its intersection with Co Rd 743 at UTM 15229453E and 3223215N, infrequent in disturbed clearing along the S boundary fence line with *Rubus argutus*, *Paspalum* spp., and *Verbesina virginica*, 3 Jul 2002, *D.J. Rosen 2221* (SBSC), in the Hudson Tract of the San Bernard National Wildlife Refuge which is on the east side of C.R. 521 north of State Hwy 35, Aug 2002, *F. Hannah s.n.* (SBSC). **Liberty Co.** in the first unit of the Trinity River National Wildlife Refuge, at parking lot for Unit off of unpaved road N of its intersection with the Davis Hill Church Rd (2252) E of Cleveland and west of the Trinity River, 20 Oct 2002, *Larry E. Brown 27442* (SBSC), in a bottomland hardwood forest in the Trinity River National Wildlife Refuge, near 30°17'23" N, 94°47'53" W, 27 Jun 2003, *Larry E. Brown 28310* (SBSC). **Orange Co.** Beaumont Unit of the Big Thicket National Preserve, at edge of parking lot for the Confluence Boat Launch site at edge of the Neches River along Four Oaks Ranch Road S of its intersection with Hwy 1139 N of Vidor, 30°09.90'N, 94°06.61'W at car in parking lot, 4 Oct 2010, *Larry E. Brown 35849* (SBSC, TAES).

Diggs et al. (2008) considered *Paspalum conjugatum* to be of conservation concern in Texas because of its limited distribution.

Setaria corrugata (Elliott) Schult. Gould (1975) reported this grass in Harris, Jasper, and Walker counties. Turner et al. (2003) mapped it in the same three counties. However, on a recent visit to TAES we found a collection of it only from Walker County. Diggs et al. (2006) reported a new record for Liberty County. We voucher here the Liberty County record and add a collection from Hardin County.

Voucher: **Liberty Co.** Menard Creek Unit of the Big Thicket National Preserve, on sandy alluvial soil near Menard Creek along CR 2142a E of the intersection with Hwy 146 and S of sign for Menard Acres housing tract, N of Rye and S of Hwy 146 bridge over Menard Creek (the west edge of the Menard Creek Unit is on the east side this road, near 30°28'05" N, 94°45'33" W), 14 Sep 2003, *Larry E. Brown 28807* (SBSC, TAES). **Hardin Co.** on deep sandy soil in the Roy Larsen Sanctuary of the Texas Nature Conservancy organization (preserve is on the N side of Hwy 327 on the E side of Village Creek and W of the village of Silsbee), 30°20' N, 94°14' W, 8 Oct 2006, *Larry E. Brown 31856* (SBSC, TAES).

This grass is somewhat frequent on the deep sands of the Roy Larsen Sanctuary in Hardin County. Allen et al. (2004) included and keyed the species for Louisiana based upon Rominger (1962) but they saw no collections for the state. Later Rominger (2003) did not map it in Louisiana. R. Dale Thomas sent SBSC a sheet identified as *Setaria italica* — we annotated it in 2003 as *Setaria corrugata*.

Voucher: **Louisiana. Winn Parish** Kisatchie National Forest, Winn Dist., Compt. 48, Stand 13, sandy soil in bluejack oak woods just N of USFS 592 and E of Sand Point, W of La. 157 and Calvin, Sec. 9 T12N, R5W, 3 Sep 1996, *R. Dale Thomas 151,670* (SBSC, NLU).

RUBIACEAE

Galium triflorum Michx. Shinners (1958) noted that this bedstraw is rare in east Texas (Sabine County) and that it also is known in Texas from a historic Reverchon collection from Dallas County. Diggs et al. (1999) noted the Dallas County collection, citing Mahler (1988), and indicated that the species has not been seen there recently. Turner et al. (2003) mapped *Galium triflorum* only in Dallas County. We do not know the basis for Shinners's report of it from Sabine County. Recent collecting in the Big Thicket National Preserve has resulted in a new record for the state.

Voucher: **Polk Co.** BTNP, Big Sandy Unit, on somewhat sandy soil in an arid upland habitat adjacent to Lily/Monroe Rd, between intersection with Sunflower Road and Hwy 1276 N of Dallardsville, 30°38'26" N, 94°40'42" W, 1 Sep 2003, *Larry E. Brown 28789* (SBSC, TAES).

In Louisiana *Galium triflorum* is mapped in 14 parishes from the Arkansas border south to the Gulf parishes of Cameron and Iberia (Thomas & Allen 1998). It is not mapped in parishes adjacent to Sabine County, Texas. Smith (1988) mapped the species in Arkansas from the mid-state region (Phillips, Garland, and Montgomery counties) north to the Missouri state border. There are no Arkansas collections from near the Texas border.

RUTACEAE

Ruta chalapensis L. Turner et al. (2003) mapped *R. chalapensis* and *R. graveolens* in Texas. Both are invasive non-natives. Turner et al. (2003) mapped *R. chalapensis* in Kendall, Real, and Presidio counties. Our collection from Galveston County, which has the fringed petals and pointed capsule lobes of *R. chalapensis* (Correll & Johnson 1979), is far distant from those previously mapped.

Voucher **Galveston Co.** Waste fields in Galveston, 1965, *R.A. Vines s.n.* (SBSC).

VERNONICACEAE

Capraria biflora L. Ideker (1996) reported this new for Texas, as *Capraria mexicana* Moric. ex Benth., from Starr County. Turner et al. (2003) mapped it with the same name in Zapata County. However, the PLANTS Database (USDA, NRCS 2009) treats *C. mexicana* as a synonym of the primarily Caribbean *C. biflora* L., and this name is used for the *Capraria* in Florida (Wunderlin & Hansen 2003). We report a recent collection from Cameron County.

Voucher **Cameron Co.** along trails in the Hugh Ramsey Nature Park, parking area off of Hwy 499 just N of the bridge over the Arroyo Colorado waterway, typical south Texas brush vegetation, 28°11.07' N, 97°39.85' W, 26 Dec 2010, *Larry E. Brown 36085a* and family (SBSC).

It is possible that the Nature Park population was derived from plants transported from one of the other known populations. Lockwood et al. (2008) indicated this 55 acre park has been "transformed into an urban oasis by extensive native landscaping projects."

ACKNOWLEDGMENTS

We thank Walter Holmes and Guy Nesom for detailed reviews of the manuscript. Larry E. Brown also thanks John Kartesz <www bonap org> for requesting distribution data from plants on deposit at SBSC. This work, which occurred over several months, resulted in the update of the nomenclature of all SBSC collections and revealed the significance of some of the plants that appear in this paper.

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NEW COMBINATION IN *PHANERA* (FABACEAE)

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ABSTRACT

Phanera yunnanensis (Franchet) Wunderlin, comb. nov., is proposed. The "Yunnan bauhinia" is grown as an ornamental in southern peninsular Florida and has been recognized in previous accounts to be naturalized in Miami-Dade County, Florida.
KEY WORDS: *Bauhinia*, *Phanera*, Fabaceae.

Phanera Raddi (Fabaceae: Cercideae: Caesalpinioideae) consists of 90–100 species native to Asia and the Malesian region of the Old World (Wunderlin 2010). The genus is readily distinguished from other genera of the Cercideae by consisting of lianas (rarely shrubs) with tendrils (rarely without) and 3 (rarely 2) fertile stamens.

The "Yunnan bauhinia," *Bauhinia yunnanensis* Franchet, native to southern China, Myanmar, and Thailand, is a glabrous, woody climber to 5 meters and blooms from late spring to early fall. Occasionally cultivated in tropical and warm temperate regions of both the Old and New World, it is easily grown from seed which is readily available from a variety of commercial sources. Naturally dispersed seeds remain viable for several years. Grown in southern peninsular Florida for several decades, it is naturalized in Miami-Dade County as reported in Wunderlin (1998), Wunderlin and Hansen (2003, 2011), and USDA, NRCS (2011). Although long regarded as a *Bauhinia*, it is best placed in the genus *Phanera* and the combination in that genus is made here.

Phanera yunnanensis (Franchet) Wunderlin, comb. nov. Basionym: *Bauhinia yunnanensis* Franchet, Pl. Delavay., 190. 1890. *Lasiobema yunnanensis* (Franchet) A. Schmitz, Bull. Soc. Roy. Bot. Belgique 110: 13. 1977.

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Bauhinia altifissa H. Léveillé, Fl. Kouy-Tchéou, 226. 1914–1915.

The name *Bauhinia* [*Phanera*] *saigonensis* Pierre ex Gagnepain of Cambodia, Laos, Thailand, and Vietnam is frequently misapplied to *Phanera yunnanensis*. The latter is distinguished by its spatulate petals that are pinkish with dark red veins and the stamens and style subequaling the petals in contrast to the linear-oblong, white petals and the stamens and style much longer than than the petals in *B. saigonensis*.

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PERSISTENCE OF THE WEED *EUPHORBIA EXIGUA* IN TEXAS

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ABSTRACT

Collections in 2002 from Kenedy County, Texas, confirm that *Euphorbia exigua* is established as a non-native invasive in the state. Previously it had been known only by a single collection from Nueces County.
KEYWORDS: *Euphorbia exigua*, *Euphorbia peplidion*, Euphorbiaceae, Texas

Continuing studies on the Flora of Texas, especially that for the Atlas of Vascular Plants of the state (Turner et al. 2003) has occasioned the following report.

Johnston (1969) was the first to report the occurrence of *Euphorbia exigua* L. in Texas, based on a collection from 4 miles northwest of Flour Bluff in Nueces County, Texas (*F.B. Jones 2925*, WWR). Subsequently, in an account of *Euphorbia* for the Manual of Vascular Plants of Texas, Correll and Johnston (1970) omitted *E. exigua* from the state's flora with the following observation under the species *E. peplidion* Engelm.: "Plants with a rather superficial appearance to *E. peplidion* but with seeds tuberculate all over are *E. exigua* L., collected once in Nueces Co. (adventive from Old World); probably not a persistent member of our flora." *Euphorbia exigua* was not included in the recent Texas Atlas (Turner et al. 2003), and the quote by Johnston was reiterated in an ongoing account of non-native species naturalized in Texas by the Texas Non-native Plants Group (2011), who concluded that the plant should be "Excluded from the Texas flora." From the comments that follow here, clearly the species should be accepted as part of the introduced flora.

F.B. Jones, who first collected the species in Texas, provided an excellent key to the taxon in his book on the Texas Coastal Bend flora (1982) but did not report any additional collections of the species. The persistence of *Euphorbia exigua* in the Texas flora is well documented by the following two collections.

TEXAS. Kenedy Co.: rare, local, ca. 50 plants in grazed bluestem grasslands on loose gray fine sand of South Texas Holocene Sand Sheet, N side of E-W stretch of road leading to 'Broken Windmill,' ca. 3 mi W of that windmill and ca. 0.5 mi NNE of HQ compound, El Canelo Ranch, 7 Mar 2002, *W.R. Carr 20435* (TEX); [same locality as preceding] but ca. 0.1 mi W to WNW of Broken Windmill, ca. 0.8 NE of HQ compound, 8 Mar 2002, *W.R. Carr 20440* (TEX).

Superficial examination of the above plants might lead to their identification as *Euphorbia peplidion*; indeed, they will key to or near that taxon in Correll and Johnston (1970), but it is clear that they are properly positioned in *E. exigua*. Map 1 shows the distribution in Texas of the native *E. peplidion* and the introduced but closely related *E. exigua*, this based upon herbarium records at LL, TEX.

Since Correll and Johnston (1970) did not provide a descriptive account of the species concerned, I provide the following, based upon the two specimens cited above.

Euphorbia exigua L.

Annual herbs 6–15 cm high. **Stems and foliage** glabrous. **Leaves** oblanceolate, mostly 10–14 mm long, 1.5–2.0 mm wide; upper most leaves mostly larger than lower (15-18 mm long, 2.3 mm wide); petioles indistinct, grading into the blades. **Cyathia** axillary, 1.0–1.5 mm high; peduncles ca 0.5 mm long; appendages 4 or 5, furcated, more or less horseshoe-shaped, ca 0.6 mm long, 1.0 mm wide, the lateral extensions white. **Stamens** 8–10, ca 2 mm long, the filaments glabrous; anthers orbicular, ca 0.25 mm across. **Styles** bifurcate, separate to the base, ca 0.25 mm long. **Mature capsules** glabrous, ca 2.5 mm high, 2.5 mm wide. **Seeds** ovoid, ca 1.5 mm long, 1.2 mm wide, evenly tuberculate-pitted throughout and bounded with minute ornamented ridges.

The following couplet should help in the identification of the taxa concerned:

1. Stem leaves mostly linear-oblanceolate to spathulate; seeds white, smooth, having 4–8 pits ..... **Euphorbia peplidion**
1. Stem leaves mostly linear, acute (rarely not); seeds pale grey, evenly tuberculate ..... **Euphorbia exigua**

Euphorbia exigua (= *Esula exigua* (L.) Haw.; *Tithymalus exiguus* (L.) Hill) also has been recorded as a naturalized member of the California flora (Thomas 1961; Munz & Keck 1968; known only from Santa Clara County), in the Canadian provinces of British Columbia, Ontario, and Nova Scotia (Brouillet et al. 2010+), and in a cluster of states in the northeastern USA — New Jersey, New York, Pennsylvania, West Virginia (USDA, NRCS 2011). It has been documented as a naturalized weed in western Europe and Australia (Randall 2007).

Euphorbia exigua is native to eastern Europe and is known as Dwarf Spurge in the British Isles (Clapham, Tutin, and Moore 1987).

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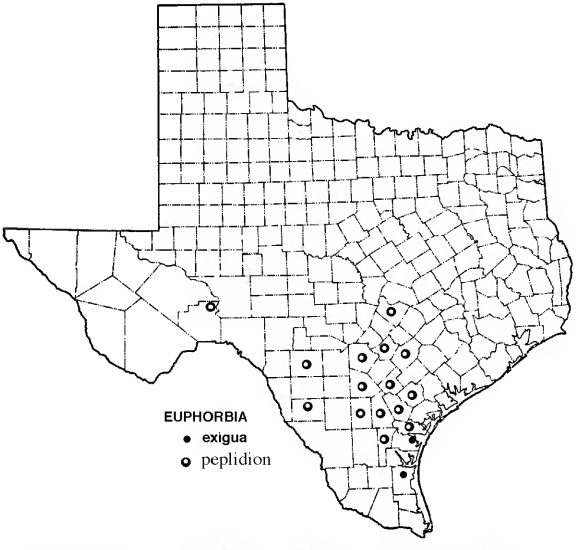

Map 1. Distribution of *Euphorbia peplidion* and *E. exigua* in Texas. Records of *E. exigua* are from Kenedy Co. (as reported here from collections in 2002) and Nueces Co. (from 1969 report).

Mink, J.N., J.R. Singhurst, and W.C. Holmes. Remarks on *Equisetum arvense* (Equisetaceae) in Texas. Phytoneuron 2011-21: 1–3.

REMARKS ON *EQUISETUM ARVENSE* (EQUISETACEAE) IN TEXAS

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ABSTRACT

Equisetum arvense, previously recorded in Texas from one collection in Lubbock County in 1932, is documented here from a recent collection in the headwaters of Murtaugh Creek in Wheeler County.

KEY WORDS: *Equisetum arvense*, Equisetaceae, Texas, Great Plains

Documentation of the presence of *Equisetum arvense* L. in Texas is based upon *E.L. Reed 3616*, collected August 1932 from Buffalo Spring in Lubbock County (Correll 1956). In *Ferns and Fern Allies of Texas*, Correll (1956) did not include herbaria as part of the exsiccatae citations but only listed (on p. 16) herbaria consulted. *Reed 3616* is presumed to have been deposited at TTC (Reed Herbarium of Texas Tech University, Lubbock). This is supported by Greuter's (1990) inclusion of all of Reed's collections catalogued to TTC in *Index Herbariorum*. Several inquiries by the authors to TTC about the specimen remain without reply.

It is not clear if Correll actually saw the specimen of *Equisetum arvense* or if the information was obtained from another source, possibly casting doubt as to the true identity of the specimen. That some uncertainty existed may be indicated in Correll's (1956) statement "... I made a brief stop at Buffalo Lakes (Springs) in the hope of relocating this species. ... no *E. arvense* was found." Alternatively, his effort may have been only an attempt to recollect the species and document its continued presence in the state because of the impending inundation of the original collection locality after creation of the Buffalo Springs Lake (reservoir) in early 1958 (Brune 1981). The result, regardless of circumstances, is that the record of *E. arvense* in Texas now rests on the "force of authority" (i.e., Donovan Correll) or literature rather than on a specimen.

Our studies on the flora of the Britt Ranch in Wheeler County have resulted in the serendipitous collection of the following specimen of *Equisetum arvense*, which unequivocably documents the occurrence of the species in the state.

Voucher specimen: **TEXAS**. Wheeler Co.: Britt Ranch, 2.3 miles N of jct of Tex Hwy 152 and FM 592, from entrance of ranch, ca. 5.1 mi. NNE to NW headwaters of Murtaugh Creek, 27 Jul 2010, *W.C. Holmes, J.R. Singhurst and J.N. Mink 15094A* (BAYLU). (Fig. 1).

A description of the occurrence area is in Mink et al. (2011).

The account of how the specimen was discovered is unusual and warrants retelling here. While the authors were inventorying the flora of the Britt Ranch in July 2010, several plants of the *Epilobium leptophyllum* Raf. (Onagraceae) were found and collected, this being a new record for the state (Mink et al. 2011). To expedite collecting, the authors place collections in a Calder field press (available from Herbarium Supply Co.), and later remove unwanted materials from the specimens. While removing the debris (soil and small plants) from the roots in prepping the *Epilobium* specimen for mounting, a small and, at the time, unrecognized species of *Equisetum* was removed from the debris. This *Equisetum* was transferred to an envelope and later mounted as an individual specimen, with an assigned number of *15094A* (the *Epilobium* specimen being *15094*). The *Equisetum* specimen was determined to be *E. arvense* based upon the relatively few number of primary ridges on the stem (~6) and nature of the leaf sheaths (Fig.1).

ACKNOWLEDGEMENTS

The authors appreciate Josh Britt's efforts in accommodating our botanical collecting trip on the Britt Ranch. Josh contributed excellent orientation and knowledge of key locations for fruitful pursuit. Additionally, we are indebted to Mr. David Britt, owner of the Britt Ranch, for permitting access to this exceptional landscape of the southern Great Plains. George M. Diggs, Jr., of Austin College in Sherman, Texas, furnished detailed information on the status of *Equisetum arvense* in the state. Finally, Darrell Vodopich contributed his expertise with camera and computer by photographing and processing the included photos of *E. arvense*.

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Mink, J.N., J.R. Singhurst, and W.C. Holmes. 2011. *Epilobium leptophyllum* (Onagraceae) in the Texas flora. Phytoneuron 2011-17: 1–3.

Fig. 1. *Equisetum arvense* L. (*Holmes, Singhurst & Mink 15094A,* BAYLU). Inset magnification 4× included scale.

Singhurst, J.R., A.E. Rushing, C.K. Hanks, and W.C. Holmes. 2011. *Isoetes texana* (Isoetaceae): A new species from the Texas Coastal Bend. Phytoneuron 2011-22: 1–6. Mailed 5 May.

ISOETES TEXANA (ISOETACEAE): A NEW SPECIES FROM THE TEXAS COASTAL BEND

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ABSTRACT

Isoetes texana Singhurst, Rushing, & Holmes, sp. nov., endemic to Calhoun and Aransas counties of the Texas Coastal Bend, is described. The new species is characterized by its aquatic habitat, leaf length of up to 62 cm, and smooth megaspore surfaces. Photos of the plant and habitat and SEM photos of the megaspores are included.
KEY WORDS: *Isoetes*, Isoetaceae, Texas, USA

Recent field study in the Texas Coastal Bend has resulted in the discovery of a previously unknown aquatic species of *Isoetes* (Isoetaceae), which is described here as new. *Isoetes texana* is the second species of the genus endemic to Texas, the other being *I. lithophila* N. Pfeiffer.

Isoetes texana Singhurst, A.E. Rushing, & W.C. Holmes, sp. nov. Figs. 1 (a and b), 2, 3, and 4.

Isoetes flaccidae A. Braun *similis sed differt paginis laevibus megasporangiorum* (*vs. paginis tuberculatis vel rugulosis*).

TYPE: **USA**. **TEXAS**. Calhoun Co.: Falcon Point Ranch, about 5 mi ENE of Seadrift, depressional pond with sandy base in Ingleside Sandhills, 10 Jun 2010, *Jason R. Singhurst 18336* (holotype: BAYLU; isotypes: BRIT, TEX).

Plants aquatic, emergent. **Rootstocks** globose, 2 lobed, 3–9 mm wide. **Leaves** evergreen, green-yellow, 24–62 cm long, pliant, gradually thinning from base to the pointed apex; velum covering whole sporangium. **Sporangium wall** unpigmented. **Megaspores** white, 350-405 µm, smooth to obscurely rugulose, girdle smooth. **Microspores** white in mass, 25–30 µm, surfaces papillose.

Representative specimens. **USA**. **TEXAS**. Aransas Co.: Aransas National Wildlife Refuge, Ingelside Sand freshwater depressional pond, 21 Oct 2010, *Singhurst 18338* (BAYLU); Calhoun Co.: Falcon Point Ranch, 0.2 mi S of jct. of Harned Road and Tex. Hwy 185, 2.8 mi E of Seadrift, Pond 1; Ingleside Sand freshwater depressional pond, 20 Oct 2010, *Singhurst, Hanks, and Hensen 18339* (BAYLU), *18340* (BAYLU), *18341* (BAYLU), *18342* (BAYLU), and *18343* (BAYLU).

Etymology. The species is named after the state of Texas. As a common name, we suggest Tejas quillwort to further honor the state. Before becoming an independent country and then a state of the USA, Texas was known as Tejas. "The word *texas* (*tejas*, *tayshas*, *texias*, *thecas*?, *techan*, *teysas*, *techas*?) had wide usage among the Indians of East Texas even before the coming of the Spanish, whose various transcriptions and interpretations gave rise to many theories about the meaning. The usual meaning was 'friends.' ... How and when the name Texas first reached the Spanish is uncertain" (Handbook of Texas Online 2011).

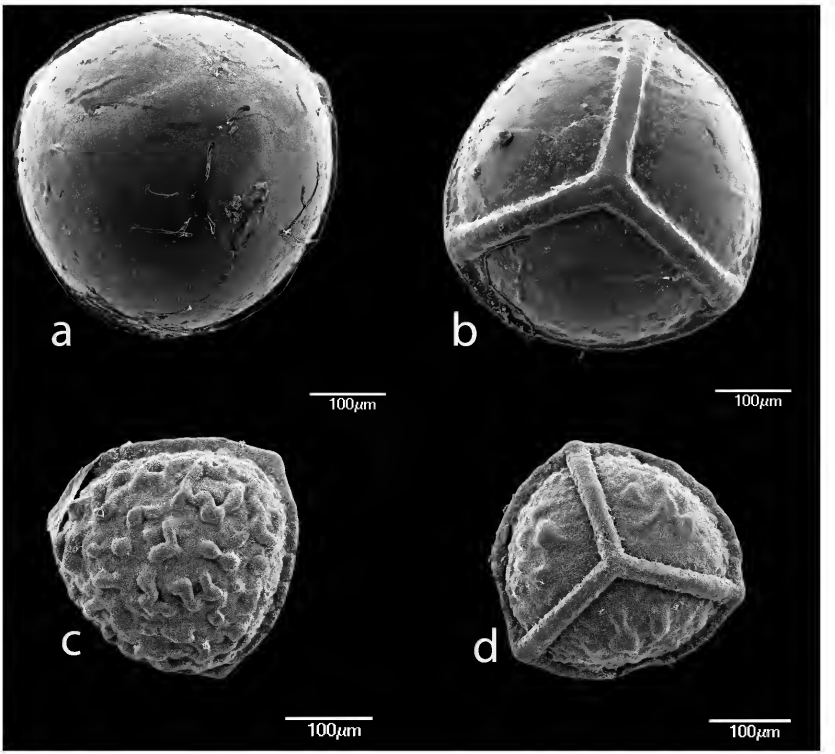

Figure 1. Megaspores of *Isoetes texana* and *I. flaccida*: (a, b) *I. texana*, *Singhurst 18336 (* holotype, BAYLU) — a. distal view, b. proximal view; (c, d) *I. flaccida*, *A.A.Eaton 337* (LL) — a. distal view, b. proximal view.

Figure 2. *Isoetes texana* (*Singhurst 18336*, holotype, BAYLU) immediately after collection. The pen is 18 cm long.

Figure 3. *Isoetes texana* at the type locality — the leaves are lying flat on water surface. Erect plants are *Eleocharis montevidensis*.

Isoetes texana is characterized by its aquatic habitat, long leaf length, megaspores of 350–405 µm with smooth surfaces (which may occasionally be obscurely rugulose), white color of microspore mass, and yellow-green leaf color (5GY 4/2-4, Munsell Color, undated).

The new species resembles *Isoetes flaccida* A. Braun of Florida and Georgia and keys near its vicinity in both Lellinger (1985) and Taylor et al. (1993). The resemblance is mainly expressed in length of the leaves and aquatic habitat. *Isoetes flaccida* differs from *I. texana* by the variable size of megaspores (250-500 µm) with tuberculate to prominently rugulate surfaces, see Fig. 1 (c and d), light brown color of the microspore mass, and bright green color of the leaves. The two species are allopatric, separated by about 1200 km at the nearest point of their ranges.

Isoetes texana is easily distinguished from the other four species reported from Texas (Holmes et al. 2005) by size and by habitat, being the only aquatic species in the state. *Isoetes lithophila* N. Pfeiffer and *I. piedmontana* (N. Pfeiffer) C.F. Reed are limited in distribution to seasonally saturated soils of granitic mountains of the Edwards Plateau vegetational region of the state and the leaves are much shorter, generally less than 15 cm. *Isoetes butleri* Englemann occurs in the same granitic mountains but is also known from glades of the Weches Formation in San Augustine and Sabine counties of east Texas. It also is generally less than 15 cm high. The other species, *I. melanopoda* Gay & Durieu, is widely distributed in the south-central USA and scattered disjunct stations further east (Taylor et al. 1993). In Texas, *I. melanopoda* occurs in seasonally wet soils in the eastern half of the state north of 29.5° latitude. This species is said to reach a height of 40 cm but is normally less than 25 cm in Texas. It may also be recognized by the pale to lustrous black color near the base of the plant and rugulate to tuberculate or reticulate megaspore surfaces.

Presently, *Isoetes texana* is known only from Aransas and Calhoun counties. It is limited to freshwater ponds and interdunal swales in neutral to moderately alkaline sands of Pleistocene and to Holocene barrier islands in the Gulf Coastal Bend of southern Texas. The vegetation is dominated by *Rhynchospora* spp., *Fuirena* spp., *Eleocharis* spp., and *Cyperus* spp. The dominant species include *Fuirena scirpoidea, Fuirena longa, Rhynchospora microcarpa*, and *Rhynchospora divergens*. Other characteristic and common species include *Rhynchospora nitens, Cyperus oxylepis, Cyperus polystachyos var. texensis, Eleocharis geniculata* (= *Eleocharis caribaea*), *Eleocharis flavescens, Eleocharis montevidensis, Eleocharis parvula, Xyris jupicai, Agalinis fasciculata, Bacopa monnieri, Buchnera americana* (= *Buchnera floridana*), *Oldenlandia uniflora* (= *Hedyotis uniflora var. fasciculata*), *Spiranthes vernalis, Drosera brevifolia*, and *Utricularia subulata*. This plant community association occupies sandy depressions of variable hydrology. Some ponds draw down and desiccate in drier periods, but *Isoetes texana* seems restricted to those that hold water throughout the year (based upon limited observations). Structure varies with depth of water (or depth to water table) and frequency of inundation, and composition ranges from a sparse cover of tufted annuals to complete coverage by rhizomatous perennials.

Figure 4. Freshwater depressional pond at the type locality on the Falcon Point Ranch in Calhoun County.

Isoetes texana is known from two locations (occurrences) and is considered globally rare with a ranking of G1S1. Immediate threats to this species include development and expansion of ponds for livestock use and human recreation (fishing). The population in Aransas National Wildlife Refuge in Aransas County is well protected. The Calhoun County occurrences are on private land and appear to

be reasonably secure at this time. Rising sea level may present a long-term threat to the species as they appear susceptible to salt water intrusion.

ACKNOWLEDGEMENTS

The authors thank Bobby Hensen for assisting the senior author with the field studies. We are also grateful to Bill Ball, owner of the Falcon Point Ranch, and Aransas National Wildlife Refuge for access to their respective properties. Scanning electron micrographs were produced by Bethany Eaton, a Baylor University undergraduate student. The herbarium of the University of Texas, Austin (TEX-LL), provided a loan of *Isoetes* specimens used in the study. Guy Nesom translated the diagnosis to Latin and reviewed the manuscript.

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RECENSION OF MEXICAN SPECIES OF *SALVIA* SECT. *STANDLEYANA* (LAMIACEAE)

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ABSTRACT

Salvia sect. *Standleyana* (including sect. *Blakea*) is treated as having five species: *S. cacalitifolia* Benth., *S. patens* Cav., *S. subpatens* Epling, *S. vitifolia.* Benth. and **S. serboana** B.L. Turner, sp. nov. A photograph of the latter is provided, along with a key to the species and maps showing their distributions.

KEY WORDS: *Salvia*, sect. *Blakea*, sect. *Standleyana*, Mexico

Preoccupation with the identification of Mexican species of *Salvia* centering about sect. *Standleyana* has occasioned the present paper.

SALVIA sect. **STANDLEYANA** Epling, Repert. Spec. Nov. Regni Veg. Beih. 110: 93. 1939. **TYPE**: *Salvia cacalitifolia* Benth.

Salvia sect. *Blakea* Epling, Repert. Spec. Nov. Regni Veg. Beih. 110: 94. 1939. **TYPE**: *Salvia patens* Cav.

Perennial herbs to 40 cm high, the roots forming well-defined slender tubers. Stems pilose, glandular-pubescent or not. Leaves large, deltoid to sub-cordate. Spikes terminal, often branched near base. Flowers mostly 2 to a node. Floral bracts ovate to lanceolate, usually persistent. Calyces large, 2-lipped, the upper 3–5-nerved. Corollas large, blue, the lips large, often markedly so. Stamens attached near bottom of corolla. Stylar shafts terete and glabrous, the apex without well-defined branches.

Epling (1939) recognized the monotypic *Salvia* sect. *Standleyana* typified by *S. cacalitifolia*. Adjacent to this he recognized sect. *Blakea* with five species, typified by *S. patens*. He noted that "In the persistent bracts and entire style it [*S. cacalitifolia*] is similar to the latter [sect. *Blakea*]" and further that sect. *Standleyana* "is singular in the small lobe of the lower lip." Regardless, the species concerned are all very similar, and I have little hesitancy in treating them within a single sect. *Standleyana*.

KEY TO THE SPECIES

1. Upper lip of corolla 26-44 mm long; central Mexico ..... **Salvia patens**
1. Upper lip of corolla 10-25 mm long; southern Mexico and Guatemala. (2)

2. Mid-stem leaves sessile or nearly so, mostly ovate to elliptic-ovate, 2–3 times longer than broad ..... **Salvia subpatens**
2. Mid-stem leaves markedly petiolate, mostly deltoid, 1–2 times longer than broad. (3)

3. Leaf-blades narrowly deltoid, 1.2–2.0 times longer than broad; lower lip of corolla mostly 10–20 mm long ..... **Salvia cacaliifolia**
3. Leaf-blades moderately to broadly deltoid, mostly 0.7-1.2 times longer than broad; lower lip of corolla 20–25 mm long. (4)

4. Plants mostly 15–40 cm high; leaves mostly basal or nearly so, the blades longer than broad; calyx lobes mostly with very short, attenuate or setiform, weakly divergent, apices I mm long or less; Ver, Pue, Gue and Oax ..... **Salvia vitifolia**
4. Plants mostly 50–100 cm high; leaves not mostly basal, the blades mostly wider than long; calyx lobes attenuate, often circinate, the apices 1.5–4.0 mm long; ne Oax ..... **Salvia serboana**

SALVIA CACALIIFOLIA Benth. in DC., Prodr. 12: 348. 1848. Map 1. **TYPE: MEXICO. Oaxaca.** Near Pueblo Nuevo, pine forests, w/o date, *Linden 132* (holotype K, photo TEX!).
Salvia atriplicifolia Fernald, Proc. Amer. Acad. Arts 35: 553. 1900.
Salvia mendax Epling, Repert. Spec. Nov. Regni Veg. Beih. 110: 96. 1938.

Erect rhizomatous herbs 30–70 cm high, producing tuberous roots. Mid-stems densely glandular-pubescent, the vestiture 1.0–2.2 mm high. Leaves mostly 6–17 cm long, 5–10 cm wide; petioles 2–8 cm long; blades deltoid, 1.2–1.8 times as long as wide, moderately to densely pubescent above and below, the margins irregularly crenulo-dentate, occasionally with 1 or 2 obtuse lateral lobes. Inflorescence, a terminal bracteate raceme 10–20 cm long, usually a single branch, but occasionally with 3 or more basal branches. Flowers 2 to a node, the pedicels 5–10 mm long. Calyces (fruiting) 9–11 mm long, glandular-pubescent, the lobes 4–6 mm long with spinulose apices. Corollas deep blue, ca. 25 mm long; lower lip ca. 15 mm long; upper lip scarcely arcuate, 16–18 mm long; tubes 18–22 mm long. Nutlets ovoid, ca. 3.5 mm long, 2 mm wide.

Oaxaca, Chiapas, and Guatemala, pine-oak forests, 2000–2700 m; flowering all seasons.

Epling (1939) treated *Salvia cacalifolia* as the sole member of his sect. *Standleyana*, largely on the basis of the shorter lower corolla lip. Standley and Williams (1973) treated *S. atriplicifolia, S. mendax*, and *S. hempsteadiana* as synonymous with *S. cacalifolia*. I consider *S. hempsteadiana* a distinct species, readily distinguished from *S. cacalifolia* by a number of characters, including corolla shape, calyx size, and stem vestiture, but since the taxon is absent from the Mexican flora, I have not included it in the present account. A typical flowering branch of *S. cacalifolia* is shown in Fig. 1.

SALVIA PATENS Cav., Icones 5: 33, t. 454. 1799. Map 2. **TYPE: MEXICO. [Hidalgo.]** "Habitat in umbrosis prope Real del Monte in Nova Hispania. Floret Augusto," *Née s.n.* (holotype: MA).
Salvia decipiens Mart. & Gal., Bull. Acad. Roy. Sci. Bruxelles 11(2): 64. 1844.
Salvia grandiflora Nee ex Cav., Icon. 5: 33. 1799.
Salvia spectabilis Kunth, Nov. Gen. Sp. (quarto ed.) 2: 304. 1817 [1818].

Perennial erect herbs 30–90 cm high, the stems producing elongate slender tubers; easily recognized by its very large, deep blue corollas with very large lips. Leaves mostly deltoid, petiolate.

San Luis Potosí, Guanajuato, Querétaro, Hidalgo, Michoacan, Mexico, Veracruz, Puebla, Guerrero, and Oaxaca, dry forests, 2000–2600 m; flowering Jul–Oct.

SALVIA SERBOANA B.L. Turner, **sp. nov.** Fig. 1 Map 3. **TYPE: MEXICO. Oaxaca.** Mpio. Santiago Llano Grande: 2.5 km NE de Llano Grande, oak forests, ca. 2490 m, 17° 52′ 32″ N, 97° 31′ 26″ W, 7 Sep 1994, *Gustavo Ramirez S. 467* (holotype: TEX).

Salviae vitifoliae Benth. similis sed differt statura majore (40–100 cm altis vs 15–40 cm), foliis plerumque caulinibus, et lobis calycum circinatis 1.5–4.0 mm longis (vs. non circinatis 1.5 mm longis vel minoribus).

Perennial, tuberous herbs, 50–100 cm high. **Mid-stems**, moderately to densely, pilose, the vestiture 1.0–1.5 mm high, often with an array of much shorter, glandular hairs. **Leaves** 10–20 cm long, 6–16 cm wide; petioles 3–8 cm long; blades deltoid, triangular-hastate to sub-cordate, pubescent above and below, more so beneath, the margins irregularly lobed and minutely crenulate or serrulate. **Capitulescence** terminal, cymose-paniculate, bracteate, 10–30 cm long, 3–5 cm wide, the peduncles 5–10 cm long, pubescent like the stems. **Calyces** (flowering) mostly 10–15 mm long, sparsely glandular-pubescent, their apices slender, often circinate. **Corollas** blue, 2–3 cm long, the lower lip ca. 10 mm long, somewhat shorter than the upper. **Nutlets,** ovoid, tan, mottled, ca. 3 mm long, 2 mm wide.

Additional specimens examined: **MEXICO. Oaxaca. Distr. Ixtlan**: 11 km N of San Juan Analco, 26 Sep 1982, *Cedillo T. 1856* (TEX); marker 139, along highway 175, ca. 2300 m, 5 Aug 1990, *Jack & Sydor 140* (TEX). **Distr. Sola de Vega**: Cara de Leon, rumbo a Recibimiento, ca. 2231 m, 23 Aug 2006, *Salinas 322* (TEX); La Cueva, ca. 2148 m, 7 Sep 2006, *Marcos 467* (TEX). **Distr. Tlaxiaco**: ca. 20 road mi W of San Miguel El Grande, steep slopes of Cerro Piedra de Olla, ca. 2950 m, 3 Aug 1990, *Soule 2433* (TEX).

Salvia serboana is most closely related to *S. vitifolia*, differing by its taller habit, broader leaf-blades, and calyces with attenuate or circinate apices. The epithet is anagrammatic, derived from Sociedad para el Estudio de los Recursos Bioticos de Oaxaca, which provided funding for collection of the material studied here.

SALVIA SUBPATENS Epling, Repert. Spec. Nov. Regni Veg. Beih. 110: 97. 1939. Map. 3. **TYPE: MEXICO. Edo. Mexico.** Distr. Temascaltepec: Tejupilco, oak woods, 1340 m, 27 Jul 1933, *G.B. Hinton 4376* (holotype: UC; isotypes: Hinton herb. photo!, K).

Salvia viscidifolia Epling, Bull. Torrey Bot. Club 67: 517. 1940.

Resembling *Salvia patens* but the leaves essentially sessile and the flowers about half the size.

Michoacan, Mexico, and Guerrero, pine forests, 1200–2600 m; flowering Jul–Oct.

SALVIA VITIFOLIA Benth., Labiat. Gen. Sp., Suppl. 724. 1835. Map 4. **TYPE: MEXICO. Oaxaca.** In Mexico ad montem ad San Felipe prope Oaxaca, *Andrieux s.n.* (holotype: P-DC, "v. s. sp. in herb. DC.," as cited by Bentham).

Salvia proxima Mart. & Gal., Bull. Acad. Roy. Sci. Bruxelles 11(2): 62. 1844.

Much resembling *Salvia cacalitfolia* and distinguished by relatively few characters, as noted above in the key.

Veracruz, Puebla, Guerrero, and Oaxaca, pine-oak forests, 2000–2700 m; flowering Jul–Oct.

ACKNOWLEDGEMENTS

I am grateful to my colleague Guy Nesom for the Latin diagnosis and helpful comments on the manuscript and to Tom Wendt for providing the image of the holotype. Distribution maps are based upon specimens on file at TEX and those cited by Epling (1939).

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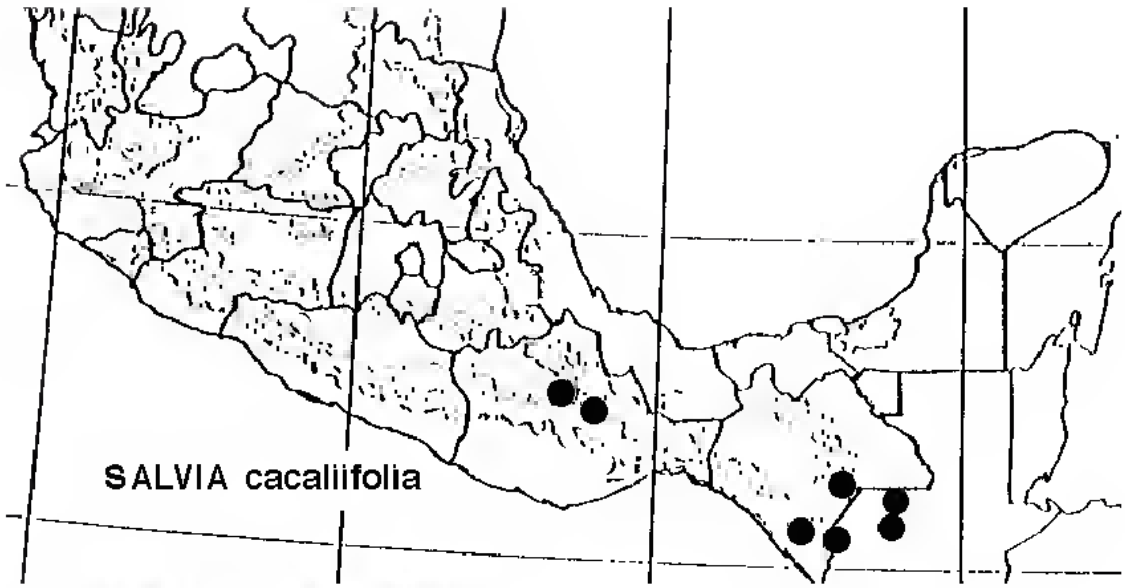
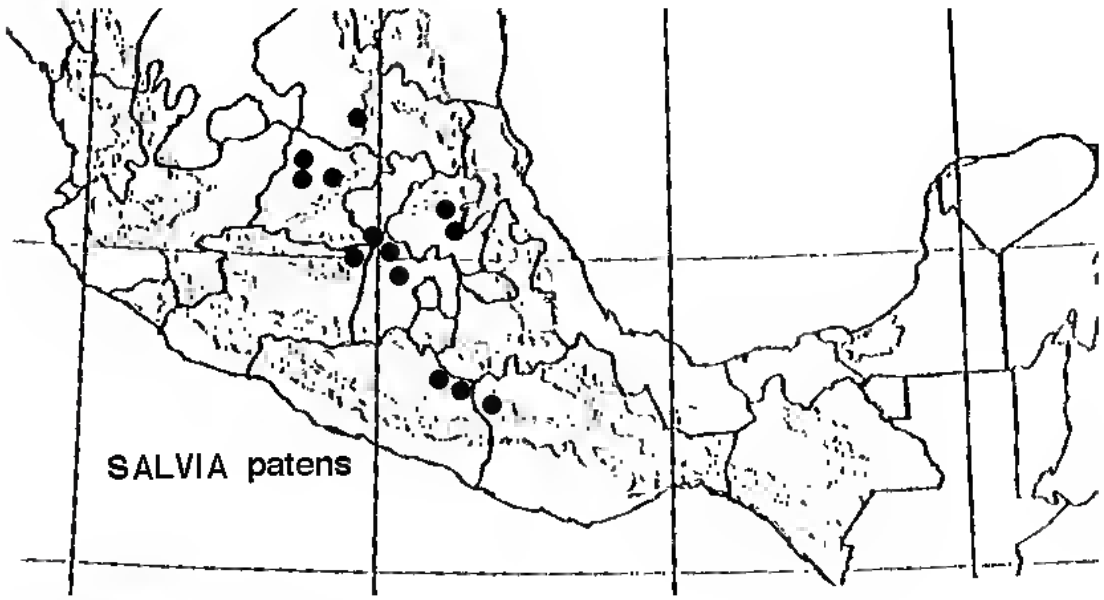
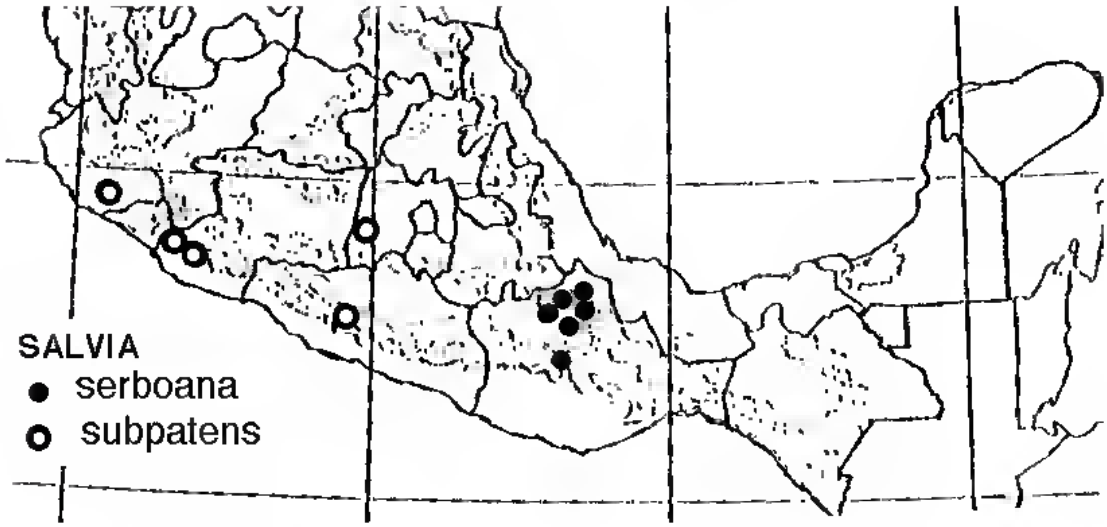
Figure 1. Holotype of *Salvia serboana*.



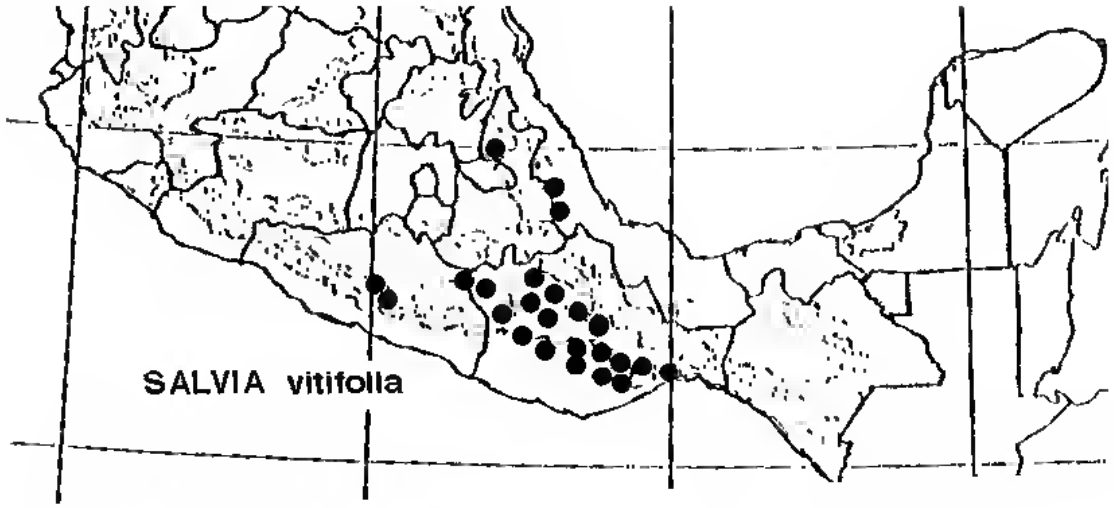
Map 1. Distribution of *Salvia cacaliifolia*.



Map 2. Distribution of *Salvia patens*



Map 3. Distribution of *Salvia serboana* and *S. subpatens*.



Map 4. Distribution of *Salvia vitifolia*.

SOLIDAGO CAPULINENSIS (ASTERACEAE: ASTEREAE) REDIVIVUS

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ABSTRACT

Solidago capulinensis Cockerell & Andrews is recollected from among basalt boulders at the base of Capulin Mountain in northeastern New Mexico and confirmed as an apparently distinct species. It also has been collected once in nearby Las Animas County, Colorado. It was described as a new species in 1936 from Capulin Mountain but apparently had not subsequently been seen or collected, nor has it been included in any account of the New Mexico or USA flora. It was sold in the Colorado nursery trade, however, from the 1930's until around the 1970's, and identification of a population in cultivation at the Pueblo Nature Center in Pueblo, Colorado, provided the incentive for a search in its natural habit. Plants of *S. capulinensis* are densely leafy subshrubs up to more than a meter tall, with numerous, ascending-erect, woody stems arising from the base and produce a greatly extended thyrsoid capitulescence, toothed leaves, and stipitate-glandular vestiture in the capitulescence. *Solidago capulinensis* is hypothesized to be most closely related to and perhaps derived from *S. wrightii* of *Solidago* subsect. *Thyrsiflorae*.

KEY WORDS: *Solidago capulinensis*, *S. wrightii*, Astereae, New Mexico

Solidago capulinensis Cockerell & Andrews was described in 1936 based on a collection from Capulin Mountain in northeastern New Mexico, but it has not been included in any subsequent account of the New Mexico or USA flora, even as a synonym (Martin & Hutchins 1981; Keller 1999; Allred 2008; Semple & Cook 2006), perhaps because it has been represented only by the type collection. Remarkably, however, a collection of the species was among western USA Asteraceae received by Nesom in 2000 for identification from Bob King and Bob Garvey, who collected it in the area of the Pueblo Nature Center in Pueblo, Colorado, along the Arkansas River about 110 miles north-northwest of Capulin Mountain.

The Nature Center plants were recognized as distinct, possibly an undescribed species, and Nesom arranged to meet King and Garvey (in September 2001) for further reconnaissance of the area where they made the collection. After a unsuccessful search in natural habitats on the shrubby hills and riparian areas around the Nature Center, about 15 large plants of the goldenrod were finally discovered to be cultivated along a walkway near the Visitor Center — King then recalling that indeed he had made his earlier collection from those cultivated plants (photos of the Nature Center plants: Figs. 7–9).

Even with good representative samples in hand, however, the plants remained unidentified for nearly another year, until browsing through the online type collection of the New York Botanical Garden led to the serendipitous recognition that the type of *Solidago capulinensis* was a match to the Nature Center plants.

A search in September 2010 at the type locality at Capulin Mountain shows the plants still grow there in abundance (Figs. 10–15), perhaps even at the exact spot where first collected by Andrews. Observations at the Pueblo Nature Center in August 2010 showed the plants of *Solidago capulinensis* to be there still, as seen in 2000 and 2001, but reduced to few in number.

Solidago capulinensis T.D.A. Cockerell & D.M. Andrews, Torreya 36: 35. 1936. **TYPE: USA. New Mexico.** [Union Co.:] Mt. Capulin National Monument, [18 Aug 1930, *D.M. Andrews s.n.*] (presumed holotype: NY!, internet image!, Fig. 2 of present report). From the protologue (p. 35): "The plant described below was found in some abundance by D.M. Andrews on rocky slopes of Mount Capulin National Monument, New Mexico, where it appeared to favor the driest positions. When transferred to the moister garden it retained essentially its natural habit, but the inflorescence became somewhat more ample in its branching."

There is no specimen of *Solidago capulinensis* at RM, where Andrews sent some specimens for identification by Aven Nelson (see RM Database 2010). Nor is there one identified as a type at COLO (COLO Type Database 2010) of the University of Colorado, Boulder, where Cockerell was on the faculty until 1934.

"Perhaps Cockerell sent the specimen to NY because of the Rydberg connection [Rydberg published floras of the Rocky Mountain region]. There is a catalog of his [Cockerell's] correspondence published by the archive, but only one letter from Rydberg in 1902. I don't know of any other specimens he sent there. As far as I know, there never was a 'Cockerell Herbarium.' The specimen is a fine one, certainly not Cockerell's style, which was usually a folded butterfly triangle" (fide W.A. Weber, pers. comm., 14 Sep 2010).

Plants perennial herbs. **Stems** ascending-erect from the base, (4–)8–12 dm tall, arising from a woody caudex, branching at least on distal half, upper stems green, 4 mm in diameter, the primary axis of the capitulescence 2–3 mm in diameter, upper stems moderately puberulent, glabrescent on older portions. **Leaves** densely arranged on the stems, relatively even-sized up to the capitulescence, elliptic-lanceolate to elliptic oblanceolate, net-veined, with 3–6 major lateral veins and a dark-colored reticulum, mostly 4–7 cm long, 12–20 mm wide, smaller into the capitulescence, basally attenuate to a subpetiolate portion 2–3 mm long, ca. 1 mm wide, not clasping, margins shallowly crenate serrate from base to tip, densely short-ciliate, flat (not revolute), thick-textured, gray-green, puberulent with arching-erect, non-glandular hairs, minutely stipitate-glandular on both surfaces. **Capitulescence** a complex cylindric-conic to pyramidal thyrse 25–40 cm long, 15–30(–35) cm wide, not at all secund, formed at the ends of major branches from an axis and spreading-ascending lateral branches, heads usually in short, subcylindric-paniculate branches; peduncles bracteate. **Capitula** turbinate-campanulate, 3–5 mm wide (pressed); phyllaries in 4–5 graduate series, lanceolate to oblong-lanceolate, apically acute, appressed, mostly 1 mm wide, slightly keeled, with a single orange-resinous midvein, inner 5.5–6 mm long, outer ca. 1/2 as long as the inner, middle phyllaries with a green patch on the distal 1/3–1/2, white-indurate below the green, innermost white-indurate (without a green patch), outermost mostly green, all sparsely puberulent, all moderately to densely minutely stipitate-glandular and resinous. **Ray florets** 11–15, pistillate, fertile, corollas yellow, erect, 5–7 mm long, 1–1.2 mm wide, tube 1–1.4 mm long; style 4–4.5 mm long. **Disc florets** 14–15, bisexual, fertile, corollas yellow, with orange-resinous nerves, glabrous, tubular-funnelform, 5–6 mm long, lobes 2.6–3 mm long, linear-lanceolate; filaments inserted 1 mm above base of corolla tube; style branches with lanceolate collecting appendages 1 mm long. **Achenes** fusiform-cylindric, 2.5–3 mm long, 0.5–0.8 mm wide, completely glabrous, with 11–14 slightly raised, resinous nerves; pappus a single series of 34–40 apically acute barbellate bristles.

Additional collections examined. **USA. Colorado. Las Animas Co.**: Mesa de Maya Region of southeastern Colorado, T34S R55W, NE 1/4 of Sec. 34, Cobert Mesa North Quad, growing in crevices of sandstone rocks in dry creekbed at the bottom of Gotera Canyon with *Melilotus alba*, ca.

5300 ft, 5 Aug 1993, *Dina Clark 238* and Penny Deihl (COLO). **Pueblo Co.**: Pueblo Nature Center, along the Arkansas River, ca. 2 mi W of city of Pueblo, row of ca. 10–15 plants, cultivated, at base of slope along paved trail, 38° 16.23" N, 104° 40.64" W, 4670 ft elev., 29 Sep 2001, *King 12006* with Nesom and Garvey (BRIT, COLO; also BRY, NY, and US fide King). Pueblo Nature Center, few plants in garden on east side of buildings and scattered plantings on the west side, 4 Aug 2010, *Nesom 2010-23* (COLO, NY, RM, UNM, WAT). A duplicate of the original collection from 2 September 2000 (*King & Garvey 11561*) is at BRIT; others presumably were distributed by King.

The primary author of the report and description of *Soldago capulinensis* was Theodore Cockerell (1866-1948), Professor of Zoology and Entomology at the University of Colorado in Boulder from 1904 until his retirement in 1934 (Weber 2000). Cockerell's specialty was zoology but he also was interested in plants and his analysis of the new species and its putative relatives was insightful. He noted that the "inflorescence resembles *S. oreophila*" [= *S. wrightii*] and "In Rydberg's Flora of the Prairies and Plains it clearly falls in the Speciosae, and apparently nearest to *S. lindheimeriana*" [= *S. petiolaris*]. His observations that "In Rydberg's key (Flora of Rocky Mountains), it runs nearest to *S. concinna* Nels." [= *S. multiradiata* Aiton, subsect. *Solidago*] and that "Our plant may be a western derivative of *S. puberula* Nuttall [of the eastern USA, subsect. *Albigula* (Raf.) Nesom], with shorter, less acute phyllaries and rough stem" emphasized the similarities in their thyrsoid capitulescences.

Solidago capulinensis is placed here as a member of *Solidago* subsect. *Thyrsiflorae* (A. Gray) A.Gray (sensu Nesom 1993; Semple & Cook 2006), which includes *S. petiolaris* Ait., *S. wrightii* A. Gray, *S. speciosa* Nutt, *S. buckleyi* Torr. & Gray, and the Mexican species *S. hintoniorum* Nesom and *S. orientalis* (Nesom) Nesom. Diagnostic features of subsect. *Thyrsiflorae* are a thyrsoid capitulescence, stipitate-glandular vestiture in the capitulescence, glabrous achenes, distinctly thickened, nearly sessile leaves, and quickly deciduous basal leaves. Species of this group have been included in recent studies (Taylor & Taylor 1984; Nesom 1993, 2008; Semple & Cook 2006).

Capulin Mountain is about 80 miles west of the westernmost populations of *Solidago petiolaris* (Fig. 1 of Nesom 2008; these plants are *S. petiolaris* var. *wardii*) and at the northern end of the range of *S. wrightii* (Fig. 1, present paper), the two closest relatives of *S. capulinensis*. *Solidago capulinensis* and *S. wrightii* (Figs. 4 and 5) are similar in their caespitose habit from thick, woody, non-rhizomatous bases, puberulent cauline vestiture, and glandular leaves. *Solidago capulinensis* is distinct from all species of subsect. *Thyrsiflorae* in its combination of large stature, large, leafy capitulescence (Figs. 2, 8, and 13–14), and relatively long disc corollas. Pertinent comparisons are given below.

1. Capitulescence a cylindric-conic to pyramidal, complex-branched panicle, heads usually in short, subcylindric-paniculate branches; disc florets 5–6 mm long, lobes 2.6–3 mm long [plants caespitose from thick, woody bases, not rhizomatous; leaves sparsely puberulent and glandular, involucres sparsely puberulent and densely glandular; achenes glabrous] ..... **Solidago capulinensis**
1. Capitulescence a flat-topped or broadly rounded corymboid cluster of short, cylindric-paniculate branches, or a subcylindric to subracemoid panicle; disc florets 3–5 mm long, lobes 1–2 mm long.

2. Plants caespitose from thick, woody bases, not rhizomatous; stems usually puberulent at least distally; uppermost leaves and involucres often minutely glandular (lens); inflorescence a more or less flat-topped, broadly rounded, or open, paniculate corymboid cluster of short, cylindric-paniculate branches, sometimes a subcylindric to subracemoid panicle; achenes strigose, rarely glabrous (in var. *guadalupensis* Nesom) ..... **Solidago wrightii**

2. Plants from a short caudex, often with a thickened, primary rhizome (commonly not evident in collections), production of scale-leaved rhizomes sometimes evident; stems glabrous to sparsely puberulent; leaves and involucres eglandular; inflorescence usually a subcylindric to subracemoid panicle; achenes glabrous or sparsely strigose at the summit ..... **Solidago petiolaris** var. **wardii**

Solidago petiolaris is generally distinct from *S. wrightii* in its combination of cylindric capitulescence, eglandular leaves, and glabrous or glabrate achenes, but vestiture and capitulescence shape vary in *S. wrightii* and no single character besides habit provides consistently diagnostic distinction between the two taxa. *Solidago wrightii* varies in vestiture from eglandular to densely stipitate-glandular, and while its capitulescence characteristically is cymoid, capitulescence branches less commonly are produced as narrow subcylindric panicles like those of *S. capulinensis*. *Solidago petiolaris* has eglandular leaves and phyllaries in its western range (= var. *wardii* (Britt.) Fern.) are eglandular and finely strigose, distinctly different from the glandular ones of *S. capulinensis* and *S. wrightii*; phyllaries of more eastern plants of *S. petiolaris* (= var. *angusta* (Torr. & Gray) A. Gray), however, are glandular and without other vestiture.

Solidago capulinensis resembles *S. speciosa* in its large capitulescence but the shorter plants with persistent basal leaves, smaller involucres, and glabrous phyllaries of the latter appear to remove it from consideration as a close relative. The populations of *S. speciosa* in Colorado and New Mexico are var. *pallida* (Porter) Semple.

It is not difficult, morphologically or geographically, to conceive of *Solidago capulinensis* as an evolutionary derivative of *S. wrightii*, perhaps as a gigas variant (a polyploid?), on the basis of its large stature, elaborated capitulescence, and larger florets. On the other hand, *S. wrightii* and *S. petiolaris* are parallel in trends of variability and *S. capulinensis* may be a relict of ancestral stock basal to both *S. wrightii* and *S. petiolaris*. In any case, *S. capulinensis* is distinct from both and appears to be fully fertile.

Capulin Mountain (Fig. 16) is in the Raton-Clayton Volcanic Field, which covers about 8000 square miles in northeastern New Mexico (Union and Colfax counties) and southeastern Colorado (Las Animas County). The single Colorado specimen of *Solidago capulinensis* that we have seen from Las Animas County suggests that it will be found in additional localities in this area. Lowrey, however, studied seven COLO collections of *S. wrightii* from southeastern Colorado (Baca and Las Animas counties) and identified all except the single collection as typical *S. wrightii*. The Mesa de Maya area needs to be carefully explored, since both species apparently occur there.

Typification of *Solidago wrightii*.

Blake (1929) concluded that *Wright 281* was the type of *Solidago wrightii*, but he did not specify which of the duplicates he was referring to: "From the name given and the first cited reference and collection it is evident that *Wright 281*, the plant on which the mention in 'Plantae Wrightianae' was based, is properly to be taken as type of the species." Nesom (2008) designated a GH collection as the lectotype.

Solidago wrightii A. Gray, Proc. Amer. Acad. Arts 16: 80. 1881. *Solidago bigelovii* var. *wrightii* (A. Gray) A. Gray, Proc. Amer. Acad. Arts 17:190. 1882. **LECTOTYPE** (Nesom 2008): U.S.A. New Mexico, "collected in expedition from western Texas to El Paso, New Mexico, May-Oct 1849, *C. Wright 281* (GH 269073!; isolectotype: US, internet image!, reproduced here as Fig. 3). From Wright's field notes, the type collection probably was made at the southern end of the Davis Mountains in Jeff Davis Co., Texas (see discussion in Nesom 2008). The GH specimen is mounted with non-type specimens of *Wright s.n.*, field #507, 1st coll. 1851 (GH 269074, and *Bigelow 504c* (GH 269075).

How did *Solidago capulinensis* reach Colorado?

No one at the Pueblo Nature Center can recall the origin of the plantings, but *Solidago capulinensis* is beautiful in cultivation and, in fact, the original collector was a horticulturalist and surely was drawn to the plants for that reason. Darwin M. Andrews (1869-1938) owned and operated the Rockmont Nursery in Boulder, Colorado, and was interested in cacti, yuccas, conifers, alpine plants, and a range of perennial herbs. Andrews brought native species from Colorado and the region into cultivation for home gardens (Ewan 1950). His scientific bent also resulted in collections of fungi (Shope 1929). In addition to the native species, he also sold trees and shrubs from the Midwest and from Europe. The Andrews Arboretum in Boulder is named for him (City of Boulder 2010).

The 1938 catalog (and perhaps others slightly earlier) from Rockmont Nursery includes an entry for the Capulin Goldenrod, *Solidago 'capulensis'* (Fig. 14) and presumably it may be established as a cultivar in various places in Colorado from this original stock. It is almost certain that the individuals of *Solidago capulinensis* originally planted at the Pueblo Nature Center were purchased through a horticultural source, but the species is apparently now no longer in the trade. A telephone survey in August 2010 of 14 native plant nurseries in Boulder, Denver, and Pueblo, Colorado, found no sources of the species and no one who had even heard of the Capulin goldenrod.

Although *Solidago capulinensis* may be discovered in additional Colorado plantings, it has not been recorded as native or naturalized in the state (e.g., Harrington 1954; Weber & Wittmann 1994, 1996; Hartman & Nelson 2001). Dr. William Weber, who received a duplicate of the Nature Center collection from 2000 (*King & Garvey 11561*), did not recognize it as a species native or naturalized in Colorado (fide Bob King, pers. comm. 2001), though he did annotate it 2001 as *Solidago wrightii*.

ACKNOWLEDGMENTS

We are grateful to the staff at NY for hospitality during recent study (Nesom) there, Bill Adams, Master Naturalist, for photos and observations (3 Sep 2010) on the flowering goldenrods at the Pueblo Nature Center, John Semple and Jerry Oldenettel for photos of *Solidago wrightii*, staff of GH for a loan (to MO) of the type of *Solidago wrightii*, staff of COLO for a loan to UNM of Colorado *Solidago*, Bill Weber for comments on T.D.A. Cockerell and the path of the type specimen of *Solidago capulinensis*, and the staff at Capulin Volcano National Monument for a collecting permit (Lowrey).

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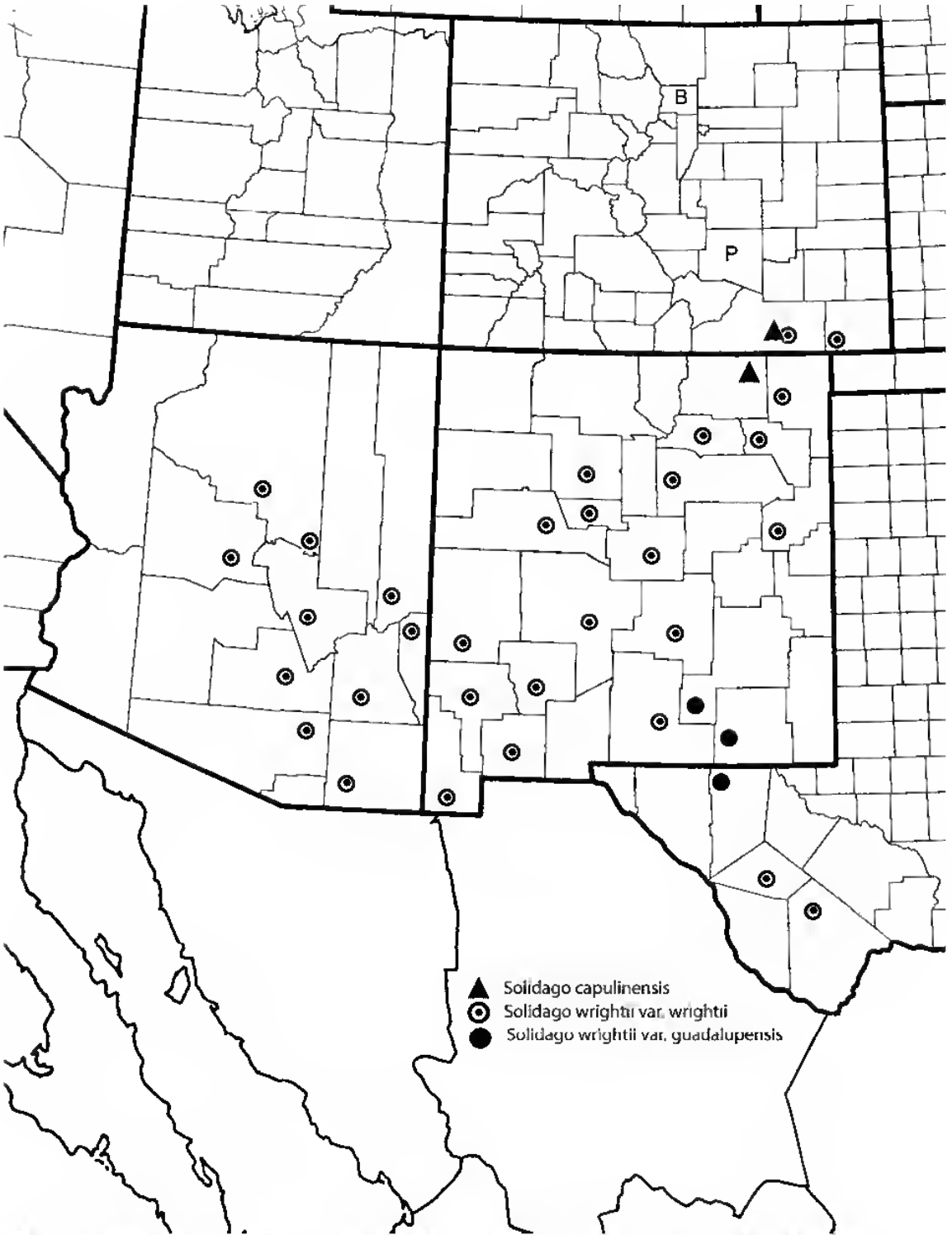


Figure 1. Distribution of *Solidago wrightii*, with Capulin Mountain and *S. capulinensis* at its northern extremity. The record for Baca County, Colorado, is added from the Specimen Database of Colorado Vascular Plants (COLO). B = Boulder, P = Pueblo. The distribution of *S. wrightii* continues southward into Mexico

Figure 2. Holotype of *Solidago capulinensis* (NY).

Figure 3. Isotype of *Solidago wrightii* (US)

Figure 4. *Solidago wrightii*, at Axel Bend on Sierra Blanca, Lincoln Co., New Mexico. Photo by Jerry Oldenettel, 19 August 2007.

Figure 5. *Solidago wrighti* (*Semple & Heard 7930*) in Arizona. Photo by John Semple.

Figure 6. Cultivated plant of *Solidago capulinensis* at the Pueblo Nature Center. In bud but not yet in flower. Photo by Nesom, 3 August 2010.

Figure 7. Cultivated plant of *Solidago capulinensis* at the Pueblo Nature Center, same as in Fig. 5. Photo by Bill Adams, 3 September 2010.

Figure 8. Branch of cultivated *Solidago capulinensis* at the Pueblo Nature Center. In bud but not yet in flower. Photo by Nesom, 3 August 2010.

Figure 9. Close-up of cultivated plant of *Solidago capulinensis* at the Pueblo Nature Center, same as in Figs. 5 and 6. Photo by Bill Adams, 3 September 2010.

Figure 10. *Solidago capulinensis* in natural habitat among basalt boulders, Capulin Volcano National Monument, Photo by Lowrey, 11 September 2010.

Figure 11. Habitat of *Solidago capulinensis* among basalt boulders, Capulin Volcano National Monument. Photo by Lowrey, 11 September 2010.

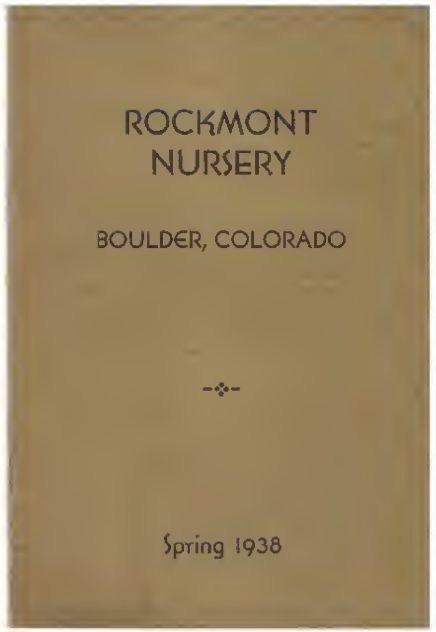
Figure 12 Habitat of *Solidago capulinensis*, hillside of basalt boulders at base of mountain, Capulin Volcano National Monument Photo by Lowrey, 11 September 2010

Figure 13. *Solidago capulinensis* capitulescence structure, Capulin Volcano National Monument. Photo by Lowrey, 11 September 2010.

Figure 14. *Solidago capulinensis* capitulescence structure, Capulin Volcano National Monument. Photo by Lowrey, 11 September 2010.

Figure 15 a, b. *Solidago capulinensis* at Capulin Volcano National Monument. Photos by Lowrey, 11 September 2010.

Figure 16. Capulin Volcano National Monument, New Mexico. Capulin Mountain, a huge cinder cone that erupted between 4,000 and 10,000 years ago, rises more than 1,000 feet above its base. Photo by R.D. Miller in Trimble (1980), U.S. Geological Survey, Dept. of the Interior.



SEDUMS AND SEMPERVIVUMS 23

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SENECIO

Lanatifolius.* Palms for its goodness-gracious leaves, the edges full and frizzled to form a peculiar wavy margin. The grayish rosettes are evergreen; flowers yellow, aster-like. Each 40c, Three $1.00.

SILENE

Alpestris. Six inches; little bunches of glistening white flowers, early summer flowering clumps. Each 40c, Three $1.00.
Schafta. Moss Campion. Small clumps in a bunch, flowers rose or purple, appear late in Sept. or Oct. when flowers in the rock garden are scarce. Each 40c, Three $1.00.

SOLIDAGO

Capulensis.* Capulin Goldenrod. Two feet, freely branching from a compact crown, very floriferous, individual florets large, like miniature golden aster. New. Each 50c, Three $1.25.
Pallida.* (Syn. S. speciosa.) Tall plumes of glowing gold, very fragrant; height 2 feet, forming a compact clump. Each 40c, Three $1.00.

SPIRAEA

The herbaceous spiraeas are referred by some authors to Filipendula. Each 40c, Three $1.00.
Filipendula. 2½ feet; feathery-cut foliage and sprays of white flowers.
Filipendula, double. Dwarfer and the flowers appear whiter than the single form.
Ulmaria Plena. The double-flowered Meadow-sweet is one of the most attractive of perennials and thrives best with a moist, medium heavy soil.

SYNTHYRIS

A charming group of rock plants with varied foliage, forming rosettes, the low flower spikes sometimes silky, suggesting the popular name, Kittentails. Loamy soil, part shade.
Plantaginea.* Silky blue-gray spikes, to 10 inches with large foliage; ordinary soil, sun. Each 40c, Three $1.00, Doz. $3.00.
Reniformis.* Oregon. Ridgeleaf. Round evergreen dentate leaves and violet-blue flower spikes in early spring; a gem for moist shade. Each 40c, Three $1.00.
Rotundifolia.* Bluebottle with unbranched foliage and 10-inch spikes of white flowers; nice plant and one of the best; easy culture with part shade and humus. Each 50c, Three $1.25.

TANACETUM

Coccineum.* Rock Tansy. A diminutive clump for the dry, sunny rock

SOLIDAGO

Capulensis.* Capulin Goldenrod. Two feet, freely branching from a compact crown, very floriferous, individual florets large, like miniature golden aster. New. **Each 50c, Three $1.25.**

Pallida.* (Syn. S. speciosa.) Tall plumes of glowing gold, very fragrant; height 2 feet, forming a compact clump. **Each 40c, Three $1.00.**

Figure 17. Front cover and page 23 of the Spring 1938 Rockmont Nursery catalog, advertising the Capulin Goldenrod for sale. The excerpt is from the right-hand column of page 23 (shown above). The catalog notes that the asterisk "Indicates Colorado and other western species."

Turner, B.L. 2011. A new species of *Davilanthus* (Asteraceae: Heliantheae) from Veracruz, Mexico. Phytoneuron 2011-25: 1–3. Mailed 25 May.

A NEW SPECIES OF *DAVILANTHUS* (ASTERACEAE: HELIANTHEAE) FROM VERACRUZ, MEXICO

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ABSTRACT

A new species, **Davilanthus veracruzanus** B.L. Turner, sp. nov., is described from Veracruz, Mexico. It is closely related to the recently described *D. hidalgoanus* (Schilling & Panero 2010) but differs by numerous features, both vegetative and floral.
KEY WORDS: Asteraceae, Heliantheae, *Viguiera, Davilanthus*, Mexico, Veracruz

Routine identification of Mexican Asteraceae has occasioned the present paper.

Davilanthus veracruzanus B.L. Turner, sp nov. Fig. 1

Davilantho hidalgoano Schilling & Panero similis sed differt foliis superis subcordatis (vs lanceolatis), bracteis involucri numerosioribus (30-35 vs 10-15) seriei intimae apicaliter reflexis (vs. non reflexis), et acheniis sparsim pubescentibus (vs. dense pubescentibus).

Type: **MEXICO. Veracruz. Mpio. Tepetlan:** 3 km despues de Colonia Enriquez rumbo a Mafafas … bosque de *Quercus*, 28 Sep 1986, *M. Chazaro B. & P. Hdez. Chazaro 4014* (holotype: TEX).

Perennial herbs to 1.5 m (?) high. **Upper stems,** sparsely pubescent with spreading hairs ca 2 mm high, beneath these a more numerous array of shorter hairs. **Leaves** (upper) mostly opposite, 10–14 cm long, 4–6 cm wide; petioles 2–3 cm long; blades subcordate, markedly appressed-pubescent beneath, less so above, the margins irregularly serrate, 3-nervate from the very base. **Capitulescence** a terminal, paniculate, leafy cyme, the ultimate peduncles 2–4 cm long, pubescent like the stems. **Heads** ca 1.2 cm high, 1.5 cm across (the rays excluded); involucral bracts 30–35, lanceolate, 6–8 mm long, 1.0–1.5 mm wide, scarcely gradate, pubescent with appressed white hairs, the innermost reflexed for 3–4 mm at their apices. **Receptacles** ca 6 mm across, paleate; pales linear-lanceolate, shorter than the disc corollas. **Ray florets** 11, sterile; rays yellow, 10–16 mm long, 4–5 mm wide; achenes abortive, flattened, glabrous, the pappus a poorly defined row of short scales. **Disc florets** numerous; corollas yellow, hispidulous; tube ca 1 mm long; throat ca 4 mm long; achenes fertile, ca 1.5 mm long, sparsely pubescent especially along their margins; pappus of two lateral scales ca 2 mm long, between these 3–4 ciliate scales ca 0.8 mm long.

When first encountered, I took the present novelty to be a species of *Viguiera*. My colleague Jose Panero, seeing the sheet concerned, called to my attention that it was certainly a close relative of *Davilanthus hidalgoanus*, this soon to be part of a proposed new genus *Davilanthus* (Schilling & Panero 2010). Subsequent study of the holotype convinced me that it represents a new member of that complex. It is named for the state of Veracruz, whence the type.

The present novelty brings to seven the number of species currently positioned in *Davilanthus*. Their distributions are shown in Maps 1 and 2.

ACKNOWLEDGEMENTS

I am, as always, grateful to Guy Nesom for the review and Latin diagnosis and to my close colleague Jose Panero for proofreading the paper and calling my attention to the relationship of the species concerned with *Davilanthus*.

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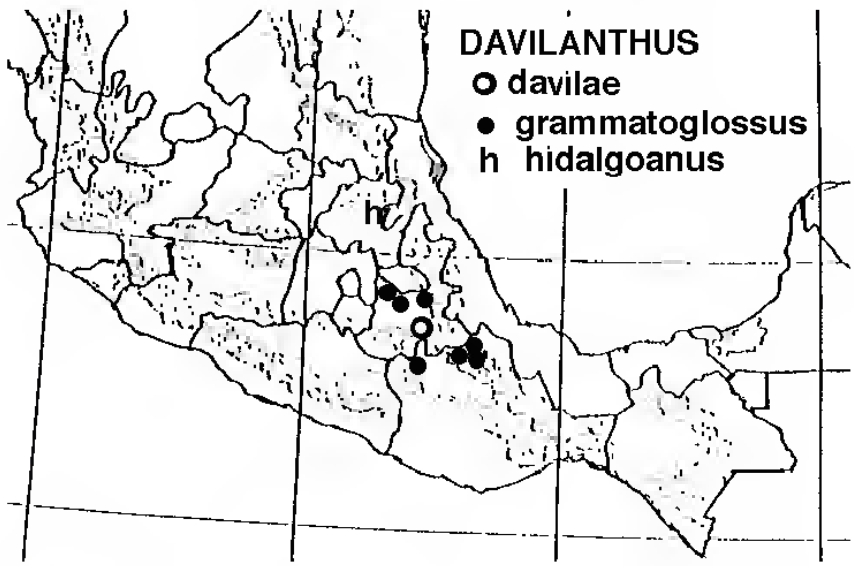
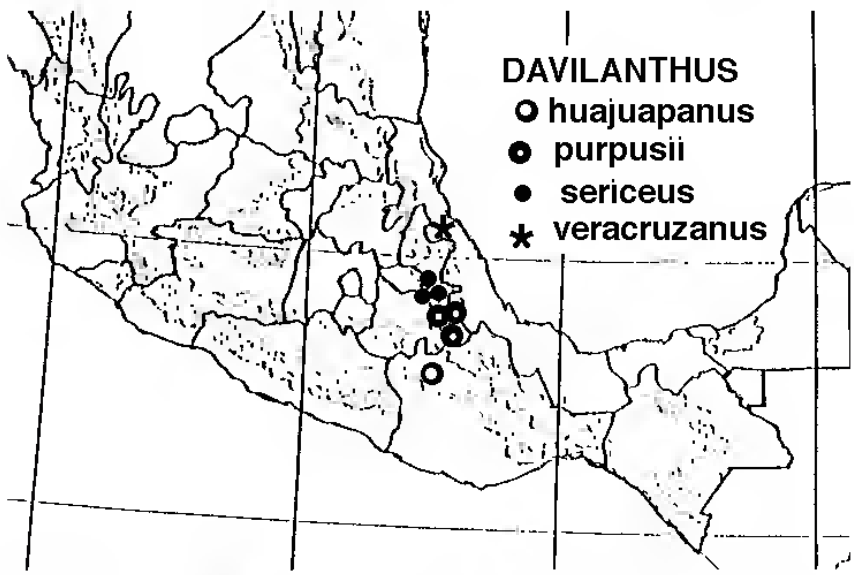


Map 1. Distribution of *Davilanthus davilae*, *D. grammatoglossus*, and *D. hidalgoanus*.



Map 2. Distribution of *Davilanthus huajuapanus*, *D. purpusii*, *D. sericeus*, and *D. veracruzanus*.

Figure 1. Holotype of *Davilanthus veracruzanus*.

Yeatts, L., B. Schneider, and A. Schneider. 2011. *Packera mancosana* (Asteraceae: Senecioneae), a new species and shale barren endemic of southwestern Colorado. Phytoneuron 2011-26: 1–8. Mailed 3 June.

PACKERA MANCOSANA (ASTERACEAE: SENECIONEAE), A NEW SPECIES AND SHALE BARREN ENDEMIC OF SOUTHWESTERN COLORADO

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ABSTRACT

Packera mancosana L. Yeatts, B. Schneider, & A. Schneider, sp. nov., is described from outcrops of grayish, argillaceous marine Mancos Shale in southwestern Colorado. The new species is currently known from several small populations in and adjacent to Lone Mesa State Park in Dolores County, Colorado, where it is represented by several hundred plants. The plants are most closely allied with the Tomentosi subgroup of the Aureoid senecios but are sufficiently different morphologically and isolated geographically from those species to be considered a distinct species.
KEY WORDS: *Packera*, Senecioneae, Mancos Shale endemic, Colorado

Biological exploration of Lone Mesa State Park in Dolores County, Colorado has brought to light a previously unknown species of *Packera*. It was first encountered in June 2008 by Betty and Al Schneider during floristic surveys of Lone Mesa State Park.

The new *Packera* exhibits salient features of the Tomentosi subgroup of the Aureoid senecios (Barkley 1988), which includes *P. cana* (Hook.) W.A. Weber & Á. Löve, *P. werneriifolia* (A. Gray) W.A. Weber & Á. Löve, *P. spellenbergii* (T.M. Barkley) C. Jeffrey (Barkley 1980; Jeffrey 1992), and *Senecio cliffordii* N.D. Atwood & S.L. Welsh (Welsh et al. 2003). This group is characterized by creeping rootstocks or stout caudices with fibrous roots, basal leaves well-developed and entire to shallowly lobed, cauline leaves progressively to abruptly reduced upward or all bracteate, leaf margins with few or no callous denticles, and some tomentum usually persistent and evident even in age.

Packera mancosana L. Yeatts, B. Schneider, & A. Schneider, sp. nov. Figs. 1–5. **TYPE: USA. Colorado**. Dolores Co.: Lone Mesa State Park, S end of the park, ca. 23 mi N of the town of Dolores, T39N, R14 W, Section 35, ca. 108° 28'W, 37° 41'N, exposure of Mancos shale, ca. 2% slope, 7575 ft; with dominants *Helianthella microcephala*, *Physaria pulvinata*, *Tetraneuris acaulis*, *Townsendia leptotes*, and *Eriogonum lonchophyllum*, abundant *Gutierrezia elegans*, *Petradoria pumila*, *Astragalus missouriensis* var. *amphibolus*, and *Heterotheca villosa*, scattered *Calochortus nuttallii*, *Delphinum nuttallianum*, *Orthocarpus purpureoalbus*, *Packera oödes*, *Solidago simplex*, and others; *Pinus ponderosa* with pinyon-juniper on nearby surrounding slopes; dense leafy mounds, flowers yellow; 26 May 2009, *Al Schneider 5077* with Betty Schneider (holotype: KHD; isotypes: COLO, MO, NY, RM, US).

Packerae werneriifoliae similis capitulis radiatis, laminis ellipticis foliorum, et pedunculis bracteatis sed differt cypselis majoribus pubescentibus et habitationibus argillae calcarei ad altitudines

recessas. *Packerae canae* similis capitulis radiatis et formae ac vestimenti laminarum foliorum sed differt caulinis brevioribus, phyllariis minus pubescentibus, foliis caulinibus abrupte deminutis, flosculis disci brevioribus, et cypselis pubescentibus.

Perennials, caespitose in dense tufted mats to 30 cm in diameter and 3 cm high, from creeping or suberect rhizomes, with stout branched caudices up to 7 mm thick at junctions; roots fleshy-fibrous. **Stems** 1 per rosette, (5.2–)7–10(–13.3) cm high, simple or 1–2-branched near midstem, lanate woolly when young, becoming floccose to rarely glabrate distally at anthesis, bracteate. **Basal leaves** petiolate, petiole dilated at base and axils obscured by white lanate tomentum, blades oblanceolate or narrowly elliptic, 29–34 mm long, 3–6 mm wide, thick, leathery, ± succulent; lanate on both surfaces, sometimes becoming floccose (rarely glabrate) in age, margins usually ± revolute, especially proximally, sometimes plane, ± thickened, ± cyanic, acute, entire with a denticle at the acute apex or apically shallowly tridentate. **Cauline leaves** 3 (-5), sessile, linear-lanceolate, 2-5 mm long, 0.1-0.01 mm wide, usually cyanic distally typically with lanate, floccose dorsal surface and floccose to glabrate, mammilate ventral surface. **Heads** solitary or 2(–3) in loosely subcorymboid arrays. **Calyculi** conspicuous, scarious, glabrate, less than 1/3 lengths of phyllaries. **Phyllaries** 15 or mostly 21 on larger heads, (5–)7–9(–10) mm long, ensiform, equal, green to cyanic, usually scarious–chartaceous and ciliate–floccose margined, floccose dorsally, erose and ciliate to tufted near apex. **Ray florets** mostly 5–8(–11), averaging 7 per head, corolla laminae 5–7 mm long, tube 3.7–4.2 mm long. **Disc florets** ± 34, 5.1–7.0 mm long, tube 1.7–2.0 mm long. **Cypselae** 3.1–4.0 mm long, with 4–5 thickened, green, short-pubescent ridges, intervals glabrous; **pappus** 4.7–5.2 mm long, capillary bristles white, nearly as long as disc floret. **Chromosome number** unknown.

Measurements for achenes and florets are from rehydrated corollas. The format of the description generally matches those in Trock (2006).

Figure 1. *Packera mancosana* at the type locality.

Additional collection USA Colorado Dolores Co; 7.5' Willow Spring quad quad, NAD27 12S 0722314E 4173556N, Lone Mesa State Park along San Juan Natl Forest Rd 514 ca. 0.3 mi W of Plateau Creek, 0.15 mi N of S entrance to Park; 7588 ft, Mancos Shale, almost flat area on barren desert pavement of broken calcareous chips, clayey soil and rock crevices; ca. 50% vegetated with *Artemisia nova, Helianthella microcephala, Orthocarpus* sp., *Townsendia leptotes,* grasses and other spp.; plants rhizomatous, forming dense mats up to 1 ft in diam., just beginning growth, leaves gray-green, tomentose-cobwebby, heads just appearing, ray and disc flowers yellow; locally common but not seen elswhere in Lone Mesa State Park, 26 Apr 2009, *Loraine Yeatts 5733* with Al & Betty Schneider and Dick Yeatts (COLO, KHD, RM, and others to be distributed). This collection (Fig. 5) is essentially from the same population as the holotype but collected one month earlier.

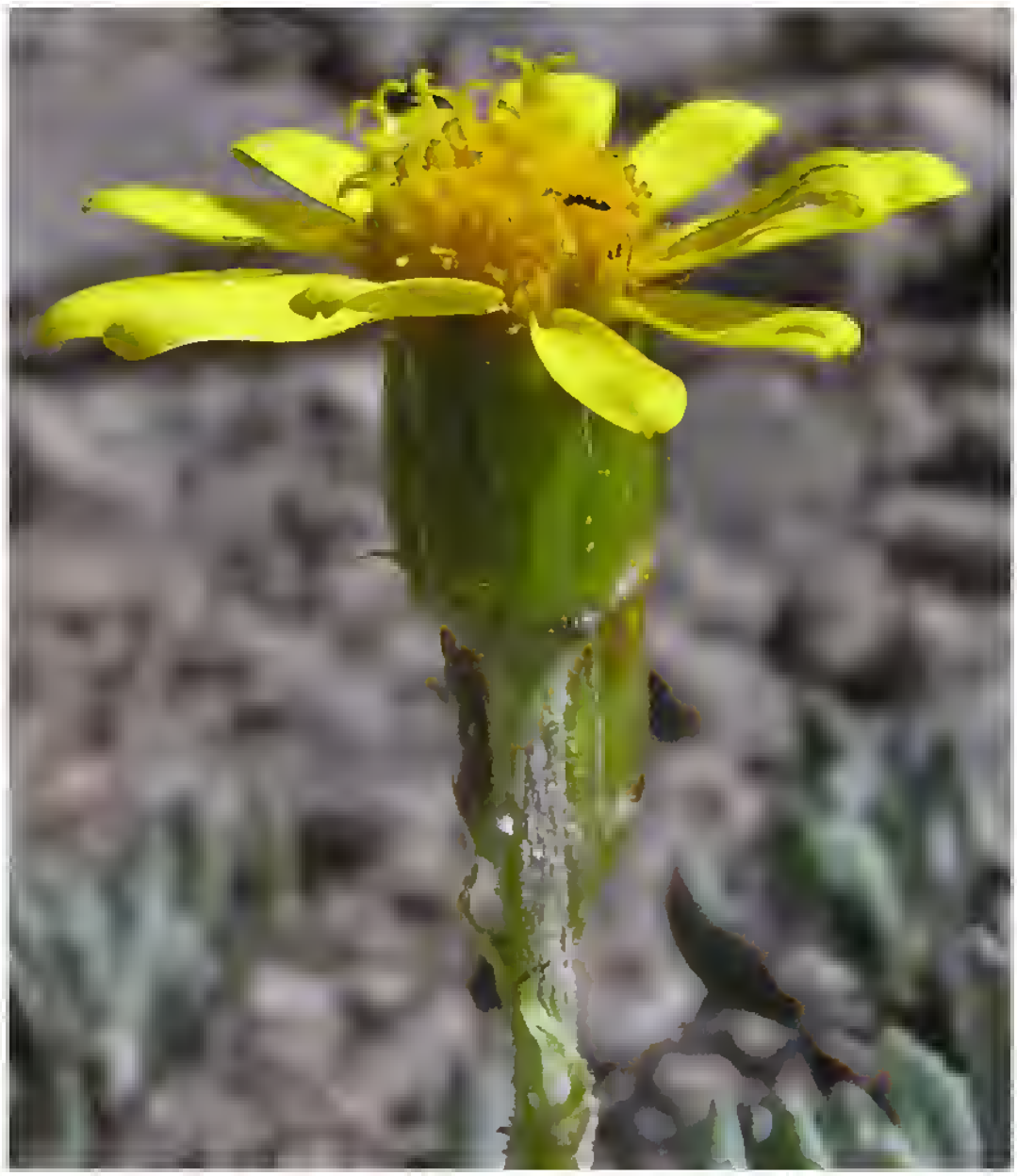

Figure 2. Head of *Packera mancosana* in Lone Mesa State Park, type locality.

Etymology. The specific epithet "mancosana" alludes to the soils on which the species is found. The name "Mancos Shale" is derived from the town of Mancos in southwest Colorado where this shale formation is abundant. **Common name:** Mancos Shale Packera.

Packera mancosana is known from several small populations that overlap the southern boundary of Lone Mesa State Park. The type locality is within the Park. Two other recently described species, *Physaria pulvinata* (O'Kane & Reveal 2006) and *Gutierrezia elegans* (Schneider et al. 2008), grow immediately adjacent to and in close proximity to *Packera mancosana*.

Figure 3. *Packera mancosana* at the type locality — growth habit.

Packera mancosana is distinguished from its closest relatives by the contrasts indicated in the key below. Information on related species is from the Intermountain Flora (Cronquist 1994), FNA treatment of the Tomentosi subgroup in (Trock 2006), A Utah Flora (Welsh et al. 2008), and the New Mexico Rare Plants website (NMRPTC 2010).

KEY TO SPECIES

1. Heads usually eradiate (rays sometimes 5–8 in *P. spellenbergii*); basal leaves sessile and linear to linear-oblanceolate, margins usually strongly revolute; cypselae pubescent on ribs.

2. Basal leaves (blades) 10–15+ x 1–2 mm; phyllaries usually 13; stems 1–2 per rosette; New Mexico (Harding and Union cos.) ..... **Packera spellenbergii**
2. Basal leaves (blades) 20–40 mm x (1–)2–3 mm wide; phyllaries 13 to mostly 18; stems 1(–2) per rosette; New Mexico (McKinley and Rio Arriba cos.), Arizona (Apache Co.), Utah (Kane Co.) ..... **Senecio cliffordii**

1. Heads radiate (rays rarely 0 in *P. werneritifolia*); basal leaves usually petiolate with mostly elliptic to lanceolate blades, margins plane or slightly revolute; cypselae completely glabrous or pubescent on ribs.

3. Cauline leaves gradually reduced distally; stems 1 per rosette; heads 8–15+ in corymbiform arrays; cypselae 2.5–3.5 mm long ..... **Packera cana**
3. Cauline leaves abruptly reduced distally, bractlike and inconspicuous; stems 1–5 or 1 per rosette; heads 1–5(–8) per stem; cypselae 1.5–2 mm or 3.1–4 mm long.

4. Leaves glabrous to glabrate at maturity, dark green, glossy; blade margins usually shallowly serrate-dentate; stems 1–5 per rosette; heads 1–5(–8) per stem; cypselae 1.5–2 mm long, completely glabrous ..... **Packera werneriifolia**
4. Leaves persistently tomentose, gray-green, dull, blade margins entire or apically shallowly tridentate; stems 1 per rosette; heads 1–2(–3) per stem; cypselae 3.1–4 mm long, pubescent on ribs ..... **Packera mancosana**

Packera werneritifolia as described by Trock (2006) is morphologically variable over its range. Leaves vary from spatulate with ovate, elliptic, or narrowly elliptic blades and flat, dentate margins in the Rockies to narrowly oblanceolate to oblong-oblanceolate and essentially epetiolate with revolute, mostly entire margins in California and Arizona (see photos on Calflora 2011). Far-western populations also tend to be more persistently tomentose than the Rocky Mountain ones. The key contrasts above are for Rocky Mountain plants.

The distinction between *Packera mancosana* and *P. werneritifolia* appears to be discontinous both in morphology and ecology and recognition of *P. mancosana* at specific rank is appropriate. *Packera mancosana* is more similar in leaf morphology to far-western expressions of *P. werneritifolia* than to Colorado ones but this similarity apparently is convergent.

Habitat. The new species is represented by a total of over 400 plants at the type locality. The plants occur as well-separated individuals on very sparsely vegetated flats (slopes ca. 2%) and sides of shallow washes. They grow along cracks in the bare shale and in thin gravelly soil over the shale. *Packera mancosana* is among the more abundant species in this habitat. Depending on the arrival of spring, it begins flowering in mid-May, fruiting into July.

Figure 4. Habitat of *Packera mancosana* in Lone Mesa State Park, type locality.

Further exploration will be needed to determine if there are additional populations of *Packera mancosana* and to determine if this species is restricted to Mancos Shale. Herbarium records studied indicate that none of the other closely related *Packera* species in the Tomentosi subgroup have been documented on Mancos Shale. Several yet unaccessioned collections of *Packera cana* at RM (Rocky Mountain Herbarium 2011) were collected on Cretaceous Pierre Shale, which probably is not calcareous but which correlates in time with Mancos Shale.

In growth habit and substrate preference *Packera mancosana* is most similar to *P. spellenbergii* and *Senecio cliffordii*, which form tufted mats on limey substrates. *Senecio cliffordii* was treated as a synonym of *P. spellenbergii* by Trock (2006), but Trock has now agreed with regional botanists who conclude that the two are distinct (NMRPTC 2010).

Packera cana is the most cosmopolitan of the group in its ecological requirements, flowering by the middle of May at low elevations (to 200 m) and much later in August at alpine altitudes (to 3700 m) on a variety of substrates. *Packera werneriifolia* is primarily found near and above treeline, occasionally lower. Of the 121 Colorado specimens of *P. werneriifolia* housed at University of Colorado Museum (CU Museum-COLO 2011), only 13 were located below 9000 feet in elevation.

Figure 5. Large mat of *Packera mancosana,* engulfing a plant of *Townsendia leptotes*. On the Mancos Shale it is common for plants to grow in close association — the first-established providing a microhabitat similar to a nurse-log.

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SITE CHARACTERISTICS OF *LEITNERIA FLORIDANA* (LEITNERIACEAE) AS RELATED TO POTENTIAL BIOLOGICAL CONTROL OF THE INVASIVE TREE-OF-HEAVEN, *AILANTHUS ALTISSIMA*

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ABSTRACT

Leitneria floridana, corkwood, an uncommon tree native to the southeastern and south central United States, may be threatened by the invasive tree-of-heaven, *Ailanthus altissima*. Field studies were conducted to assess the morphology and site characteristics of *L. floridana* throughout its native range and to determine if *Ailanthus altissima* has invaded *L. floridana* populations. One site in Georgia, Texas, Arkansas, and Missouri, and two sites in Florida were examined. Plants at site #1 in Florida were significantly taller and had a larger trunk diameter than any other location throughout *L. floridana* distribution. Plant density was greatest at site #1 in Florida; however, the amount of *L. floridana* was greatest at site #2 in Florida. Water depth varied at the time of sampling from 0–31 cm across its distribution. *Atteva punctella* (Cramer) (Lepidoptera: Yponomeutidae) was the only herbivore found feeding on *L. floridana*. The following woody species were found associated with *L. floridana*: *Sabal palmetto*, *Triadica sebifera*, *Sesbania drummondii*, *Quercus lyrata*, *Liquidambar styraciflua*, *Carya aquatica*, *Magnolia virginiana*, *Fraxinus pennsylvanica*, *Prunus serotina*, *Cephalanthus occidentalis*, *Taxodium distichum*, and *Ulmus americana*. *Ailanthus altissima* was not found in *L. floridana* habitats. Management of *A. altissima* for the protection of *L. floridana* is discussed.

KEY WORDS: *Leitneria floridana*, corkwood, *Ailanthus altissima*, tree-of-heaven, invasive species management

Corkwood, *Leitneria floridana* Chapm. (Leitneriaceae), is a rare tree native to Georgia, Florida, Texas, Arkansas, and Missouri, with at least one known cultivated population in Illinois (Sharma & Graves 2004, USDA-NRCS 2007). Specimens also have been collected by the Parks Department in Rochester, New York, in 1925, 1927, and 1968 but there is no evidence that the species still occurs there (Koller 1997). *Leitneria floridana* occurs in brackish and fresh water marshes, wet woodlands, swampy prairies, and estuarine shores (Koller 1997; Sharma et al. 2008).

The classification of corkwood has endured substantial debate since its first discovery by Dr. E.T. Leitner in 1835 in the salt water marshes of Florida's Apalachicola River (Koller 1997). Past workers have placed *Leitneria floridana* in Simaroubaceae (Petersen & Fairbrothers 1983; Fernando

et al. 1995; Gadek et al. 1996; Soltis et al. 2000; Judd et al. 2002; Jacobs 2003), but more recently the species has been placed back into Leitneriaceae (Sharma et al. 2008).

Leitneria floridana has a global conservation rank of G3 (vulnerable; either very rare and local or found locally in a restricted range). It has a state rank of S1 (critically imperiled because of extreme rarity) in Georgia and Texas, S2 (imperiled because of rarity) in Missouri, and S3 (very rare and local or found locally in a restricted range) in Arkansas and Florida (Sharma et al. 2008; NatureServe 2009; CPC 2010). It is generally accepted that *L. floridana* rarity is due to habitat destruction, land management practices for recreational purposes, and poor competitive ability (Koller 1997; Rosen et al. 2006).

Tree-of-heaven, *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae), is a dioecious, rapidly growing (1.5 meters a year), medium to large tree (25–35 m) that produces up to 300,000 seeds a year (Sheppard et al. 2006). It is an introduced and invasive species in North America (Ding et al. 2006). Seed was introduced from China to Paris between 1740 and 1750 (Hu 1979; Tellman 2002) and into North America as an ornamental shade tree during the late 18th century from Europe into Philadelphia, Pennsylvania (Feret 1985; Tellman 1997). Multiple introductions into New York occurred during the early 19th century (Davies 1942; Dame & Brooks 1972; Hu 1979). The last historical record of *A. altissima* introduction(s) into the United States occurred during the gold rush in the mid 19th century when Chinese laborers brought the tree into California from Chinese seed stock for its medicinal and cultural value (Tellman 2002).

Tree-of-heaven is established throughout most of the United States from Washington to New England and south to northern Florida, Texas, and southern California (Kartesz & Meacham 1999; Howard 2004; USDA-NRCS 2007), its relative abundance variable throughout its distribution. It is most common near its centers of initial introduction and less common in areas distant from its introduction. It has become established in a wide variety of ecosystems, from oak-hickory to freshwater tidal estuaries (Garrison et al. 1977; Kiviat 2004) and has become a serious threat to habitats throughout its North American distribution. It is registered as a noxious weed in New Hampshire, Vermont, Connecticut, and California (USDA-NRCS 2007). Nationally, the tree has become an economic and ecological pest.

Many invasive plant species produce allelopathic compounds that are capable of suppressing the growth of alternate plant species, reducing competition. *Ailanthus altissima* produces the compound ailathone, which is capable of suppressing more than 90 species (Mergen 1959). The allelopathic properties of *A. altissima* may further threaten *Leitneria floridana* if it encroaches into *L. floridana* habitats.

Investigations into the use of biological control for suppression of *Ailanthus altissima* were initiated in 2004. A weevil, *Eucryptorrhynchus brandti* (Harold) (Coleoptera: Curculionidae), was identified in China and imported to the Virginia Tech's Beneficial Insect Quarantine Facility for testing as a possible biological control agent (Ding et al. 2006). Herrick (2011) and Herrick et al. (2011) studied the life history, development, host range and rearing protocol for this species in quarantine. Results indicate that substantial feeding by *E. brandti* adults occured on *Leitneria floridana* foliage in no-choice tests. However, feeding on *A. altissima* foliage was significantly greater and preferred when adults were given a choice of *A. altissima* and *L. floridana*. Besides *A. altissima*, *L. floridana* was the only other species among 29 plant species tested that showed feeding by the weevil (Herrick 2011).

Native plant community structure and diversity can be negatively altered by the invasion of non-indigenous species like *Ailanthus altissima* (Westbrooks 2001; Woods 1993; Zimdahl 1995; Olden & Poff 2003; Heady et al. 1992; Rosen & Faden 2005; Rosen et al. 2006). *Ailanthus altissima* occurs in every state that *Leitneria floridana* occurs in. However, it is only known to occur in the same counties in Jefferson and Franklin counties (Florida), Brazoria County (Texas), Jefferson, Craighead, and Mississippi counties (Arkansas), and Ripley County (Missouri) (USDA-NRCS 2007).

In counties where both species occur, it is not known if they occupy the same habitats, how close in proximity they occur, or if the habitats support coexistence of the two species. Therefore, a field survey was conducted of *Leitneria floridana* throughout its native range to gain a better understanding of the species in its native habitat and to determine if *Ailanthus altissima* has invaded or has the potential to invade *L. floridana* habitats. This information will allow us to better address future biological control tactics for *A. altissima* as it relates to *L. floridana* and the use of the potential biological control agent *Eucryptorrhynchus brandti*.

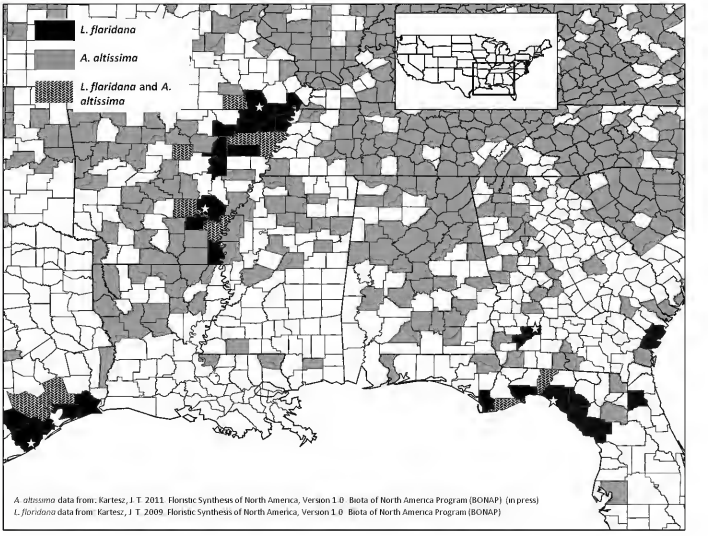

Figure 1. County distribution of *Leitneria floridana*, *Ailanthus altissima*, and sample site locations (star) in the southeastern and south central United States.

Materials and methods.

From 9 September through 5 October 2009 native sites of *Leitneria floridana* were visited in the Joseph W. Jones Ecological Research Center at Ichauway, Dougherty County, Georgia (31° 42' 48" N; -84° 44' 44" W, at 52.1 meters alt.); Big Bend Wildlife Management Area, Snipe Island, Taylor

County, Florida (site #1, 30° 12' 72" N; -83° 96' 92" W, at 7.3 m alt.; site #2, 30° 12' 50" N; -83° 97' 03" W, at 14.6 m alt.); San Bernard National Wildlife Management Area, Bird Pond Unit, Brazoria County, Texas (29° 08' 18" N; -95° 12' 33" W, at 14.5 m alt.); Bayou Meto Wildlife Management Area, Cox Cyprus Lake, Arkansas County, Arkansas (34° 28' 67" N; -91° 63' 14" W, at 53.3 m alt.); and Sand Pond Conservation Area, Ripley County, Missouri (1 site, 36° 50' 35" N; -90° 60' 00" W, at 92.7 m alt.) (Fig. 1). These sites were chosen because they were the most easily accessible or were previously known by herbarium specimens and/or recommended by scientists in the area.

At each site, a 10 m^2 quadrate was established around *Leitneria floridana* stands to estimate the density of the stand. This quadrate size was chosen because *L. floridana* colonies were small and permitted sampling the entire population at most sites. Within each quadrate *L. floridana* height, trunk diameter, trunk taper, alternate woody species, water depth, and number of herbivores per plant were calculated or recorded. Trunk diameter was measured at breast height at site #1 in Florida. Trunk diameter was measured halfway from the base to the top of the plants at the remaining sites because they were shorter than breast height. The trunk taper was classified as described by Brack (1999) and Socha and Kulej (2007): < 0.25 cm/m, neiloid; > 0.26 and < 0.49 cm/m, conoid; > 0.50 and < 0.59 cm/m, quadratic paraboloid; and > 0.59 and < 0.99 cm/m; cubic paraboloid; and > 0.99 cm/m, cylindrical.

To determine if additional *Leitneria floridana* stands and/or *Ailanthus altissima* were present near the *L. floridana* stands, four 100 m transects were established from each quadrate. Ninety degrees from the center of the north, south, east, and west edge of each quadrate, a 100 m transect was established. Plant height, trunk diameter, trunk taper, and water depth were analyzed with analysis of variance and least square means Tukey-Kramer HSD at $\alpha = 0.05$. All other measures were not replicated, so they were not compared statistically among the sites.

Results.

Leitneria floridana at Florida site #1 was significantly taller and had greater trunk diameter than at all other sites, suggesting that the site was older and established before the other sites that were sampled (Table 1). Also, the Florida #1 site was not shaded by overstory vegetation while all other sites were, suggesting that *L. floridana* is a poor competitor in shaded environments. Plant height was similar at Florida site #2, Georgia, Texas, and Missouri sites. However, plants were significantly taller at Florida site #2 than at the Arkansas site. Trunk diameter at Florida site #2 was significantly greater than *L. floridana* sampled at the Georgia, Texas, Arkansas, and Missouri sites (Table 1). Trunk taper at Florida site #1 and Florida site #2 differed significantly from *L. floridana* at the Georgia, Texas, and Arkansas sites but not the Missouri site. Using the trunk taper classification, plants at Florida site #1, Florida site #2, and Missouri have a cylindrical trunk, Georgia and Texas plants have a quadratic paraboloid taper, and Arkansas plants have a cubic parabloid taper.

Leitneria floridana density was at least 3 times greater at Florida site #1 than at the Florida site #2 and Georgia sites, again suggesting that it is an older site. Texas, Arkansas, and Missouri sites had the lowest density (Table 1). Across all 100 m transects, Florida site #2 had the greatest amount of *L. floridana* from the main sampling quadrate followed by Arkansas then Texas. *Leitneria floridana* was sparse or absent within 100 m from the main sampling quadrates at Florida site #1, Georgia, and Missouri sites (Table 1). Minimum water depth was greatest at the Florida site #1 site followed by the Georgia site. Maximum water depth was greatest at Florida site #1 and Georgia site followed by Florida site #2. Standing water was absent in some locations at Florida site #2 and completely absent at the Texas, Arkansas, and Missouri sites. Soil was saturated at sites where standing water was

absent. Mean water depth was similar at the Florida1 and Georgia sites. Water depth was significantly greater at Florida site #1 than at Florida site #2, Texas, Arkansas, and Missouri sites (Table 1).

The only herbivore found (larvae and pupae) was *Atteva punctella* (Cramer) (Lepidoptera: Yponomeutidae) at Florida site #2 (n = 48), Texas (n = 10), and Arkansas sites (n = 7).

Leitneria floridana was the most common species in most of the sites, ranging from 47 to 90% of the total woody stems. However, the Missouri site had substantially more *Quercus lyrata* (51%) than *Leitneria floridana* (20%) (Table 2). Across all sites, *Carya aquatica* was commonly found growing in association with *L. floridana*, excluding Georgia which had *Taxodium distichum* growing as the next most common species. *Ailanthus altissima* was not found at any of the sites. However, the invasive tree *Triadica sebifera* was found in close association with *L. floridana* in Texas (Table 2).

Discussion.

Leitneria floridana grows in small isolated populations and is often inundated by standing water or found growing in previously inundated and moist soils. The majority of locations investigated contain short, wispy plants that are small in diameter. Sharma et al. (2008) suggested that the Missouri population was the most unique phenotypically, based on morphology, physiology, and growth habits. They also reported that plants in Missouri were taller than plants in Florida, but our results indicate that Florida plants were two times taller and the diameter was approximately two times larger than *L. floridana* in Missouri.

Trunk taper, or the breast height form factor, is used by foresters to aid in determining trunk volume and yield (Brack 1999). This measurement also is used as a morphological measure to determine phylogenetic relatedness (Socha & Kulej 2007). Regarding trunk taper, the only similarity that was found with Sharma et al. (2008) was in the cylindrical trunk shape of the Florida plants. These differences in results were most likely due to differences in site location, measurements, and age of the sites sampled.

Future studies need to encompass several sites across the distribution *Leitneria floridana* in each state and during different times of the year to accurately assess the species ecological role within the community it grows in and across its distribution. Genetic analysis would be useful in determining the relatedness of *L. floridana* provenances.

Native plant community structure and diversity can be negatively altered by the invasion of non-indigenous species (Rosen et al. 2006). For example, at a site location similar to ours in Brazoria Co., Texas, Rosen et al. (2006) found decreased species richness within plots containing *Cyperus entrerianus* Boeckeler (Cyperales: Cyperaceae).

Anthropogenic activities contribute toward the invasion of invasive species (Byers 2002). The presence of the invasive tree *Triadica sebifera* in the Texas site suggests that other invasive species such as *Ailanthus altissima* have the potential to invade *Leitneria floridana* habitats.

Ailanthus altissima is encroaching on *Leitneria floridana* habitats (Fig. 1). Although it was not found growing in association with *L. floridana*, site conditions might support its growth in communities adjacent to *L. floridana* colonies. Many of the sites that were visited were inundated with water. It is not known if *A. altissima* can grow in inundated conditions, but it has been reported invading upland estuarine habitats (Kiviat 2004), woodland communities, and it thrives in sites influenced by anthropogenic activities (Kowarik 1995).

All of the sites that were visited in our study were generally isolated; but every site had evidence of anthropogenic activity in the vicinity of *Leitneria floridana* stands. The Georgia, Arkansas, and Missouri sites were close to access roads for recreational purposes, the Florida sites maintain access roads for housing and recreation, and the vegetation at the Texas site was managed for hunting access and quality. Most sites in this study were selected partially for ease of accessibility based on herbarium specimens and local botanists in the areas owing to the presence of anthropogenic activities. The Texas site was the least accessible and did not have any access roads.

While conservation efforts are common for *Leitneria floridana* management (CPC 2010), managers of invasive plant species also need to be aware of such sensitive species and incorporate management tactics to have as little impact on such species. Potential biological control programs against *Ailanthus altissima* must consider its potential impact on *L. floridana* due to their taxonomic affinity. We now know much more information pertaining to the site conditions of *L. floridana* habitats. In addition, *A. altissima* is not present in the immediate vicinity of *L. floridana* habitats. Future studies should focus on the potential allelopathic impact of *A. altissima* on growth of *L. floridana* if they were to occur together. Also, it is not known if *A. altissima* can persist in conditions inundated with water and should be studied.

Based on the habitat that *Leitneria floridana* grows in, and the lack of *Ailanthus altissima* in the vicinity of *L. floridana*, the potential biological control agent *Eucryptorrhynchus brandti* does not appear to pose a significant threat to *L. floridana*. However, ongoing oviposition and larval development studies of *E. brandti* on *L. floridana* will determine if this potential agent should be released from quarantine.

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Table 1 Morphology measured (SE) and site characteristics of *Lu. flaviscutellata* sampled at sites in Georgia, Florida, Texas, Arkansas, and Missouri.

	State/Sites					
Measurement	Georgia	Florida #1	Florida #2	Texas	Arkansas	Missouri
Head length (mm)	1.104 ± 0.14a	2.39 ± 0.08a	1.20 ± 0.13b	0.096 ± 0.16a	0.79 ± 0.15c	0.67 ± 0.29bc
Trunk diameter (mm)	0.67 ± 0.17a	2.57 ± 0.11a	1.30 ± 0.15b	0.48 ± 0.25c	0.59 ± 0.18c	0.55 ± 0.25c
Trunk length (mm)	0.54 ± 0.07a	1.08 ± 0.05a	1.05 ± 0.07a	0.53 ± 0.08c	0.69 ± 0.08bc	0.90 ± 0.12ab
Lu. flaviscutellata	43	12	48	15	17	07
North transect density (plants/m²)	0	0	1	0	0	0
South transect density (plants/m²)	0	0	4.5	0	1.7	0
East transect density (plants/m²)	0	0	4.8	0	1.6	0
West transect density (plants/m²)	0	0	0	1.53	0	0
Min. water depth (cm)	5.08	30.48	0	0	0	0
Max. water depth (cm)	30.48	30.48	10.19	0	0	0

*Means followed by the same letter across each row are not significantly different at $P < 0.05$, Least Square Means Tukey-Kramer HSD test.

Table 2. Percent woody species growing in association with *L. flaccidissima* at sampling sites in Georgia, Florida, Texas, Arkansas, and Missouri.

			State/Sites					
Family	Species	Common name	Georgia	Florida #1	Florida #2	Texas	Arkansas	Missouri
Arecaceae	*Sabal palmetto* (Walter) Lodd. Ex Schult.	cabbage palmetto	0	2.2	7.9	0	0	0
Euphorbiaceae	*Triadica sebifera* (L.) Small	Chinese tallow	0	0	0	18.7	0	0
Fabaceae	*Gleditsia aquatica* Marshall	waterlocust	0	0	0	9.4	0	0
Fagaceae	*Quercus laurifolia* Michx.	swamp laurel oak	3.9	0	0	0	18.4	51.4
Hamamelidaceae	*Liquidambar styraciflua* L.	sweetgum	1.3	0	0	0	0	0
Juglandaceae	*Carya aquatica* (Michx. f.) Nutt.	water hickory	0	8.2	14.3	18.7	12.9	17.1
Magnoliaceae	*Magnolia virginiana* L.	sweetbay	1.3	0	0	0	0	0
Oleaceae	*Fraxinus pennsylvanica* Marshall	green ash	0	0	0	6.3	0	0
Rosaceae	*Prunus serotina* Ehrh.	black cherry	1.3	0	0	0	0	0
Rutaceae	*Ptelea trifoliata* L.	common hoptree/wafer ash	3.9	0	0	0	0	0
Simaroubaceae	*Ailanthus altissima* (Mill.) Swingle	tree-of-heaven	0	0	0	0	0	0
Lauraceae	*Lindera benzoin* (L.) Blume	northern spicebush	53.8	89.6	76.2	46.9	34.8	2.0
Taxodiaceae	*Taxodium distichum* (L.) Rich.	baldcypress	29.9	0	0	0	0	0
Ulmaceae	*Ulmus americana* L.	American elm	2.6	0	1.6	0	12.9	11.4
Total number of species			8	3	4	5	4	4
		Total number of plants per site	77	134	63	32	31	35

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RECOGNITION AND SYNOPSIS OF *MIMULUS* SECT. *TROPANTHUS* AND SECT. *LEUCOCARPUS* (PHRYMACEAE)

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ABSTRACT

The American genera *Hemichaena* (5 species) and *Leucocarpus* (1 species) are formally brought into *Mimulus* as *Mimulus* sect. *Tropanthus* A.L. Grant and **Mimulus** sect. **Leucocarpus** (D. Don) Nesom, comb. et stat. nov. Sect. *Leucocarpus* includes only *M. perfoliatus* Kunth. Thieret (1972) united the five species of *Berendtiella* and *Hemichaena* into the single genus *Hemichaena* and all five species are formally transferred here to *Mimulus*. The original *Mimulus* sect. *Tropanthus* of Grant (1924) included only the single species *M. treleasei* (= *Hemichaena levigata*) and the section as revived here and expanded includes these: **Mimulus coulteri** (A. Gray) Nesom, comb. nov., **Mimulus fruticosus** (Benth.) Nesom, comb. nov., **Mimulus levigatus** (B. Rob. & Greenm.) Nesom, comb. nov., **Mimulus spinulosus** (S. Wats.) Nesom, comb. nov., and **Mimulus rugosus** (Benth.) Nesom, comb. nov. A lectotype is designated for *Hemichaena fruticosa* Benth. Sect. *Tropanthus* and sect. *Leucocarpus* are shown by molecular data to have originated as sister to one or the other of the two main clades of American *Mimulus*, and for consistency, recognition of *Hemichaena* and/or *Leucocarpus* would require that western American *Mimulus* be divided into at least two genera. In contrast to the single-flowered inflorescences characteristic of most *Mimulus* species, *Hemichaena* and *Leucocarpus* both produce pedunculate multi-flowered bracteolate cymes, which are interpreted as a primitive feature. The shrubby habit of *Hemichaena* is paralleled in species of *Mimulus* sect. *Diplacus* and the baccate fruits diagnostic of *Leucocarpus* are a specialization approached in function by initially indehiscent capsules in some groups of western USA *Mimulus*.

KEY WORDS: *Hemichaena*, *Berendtiella*, *Mimulus* sect. *Tropanthus*, *Leucocarpus*, *Mimulus* sect. *Leucocarpus*, Phrymaceae

Molecular-phylogenetic studies of *Mimulus* (Beardsley and Olmstead 2002; Beardsley et al. 2004; Beardsley & Barker 2005) have provided insights into its phylogenetic structure and putative relatives. *Mimulus* sensu stricto, including *M. ringens* L., *M. alatus* Ait., and two Southern Hemisphere species, is sister to a clade of primarily Australian taxa, including several generally recognized genera (Fig. 1). Sister to the Australian clade is a branch of two mostly American clades — *Mimulus* subg. *Synplacus* A.L. Grant and *Mimulus* subg. *Schizoplacus* A.L. Grant, together including about 140 species — with the monotypic *Phryma* L. at their base. *Leucocarpus* D. Don (1 species) is sister to subg. *Synplacus*, while *Hemichaena* Benth. (5 species) is sister to subg. *Schizoplacus*.

In order to retain the name *Mimulus* for the large number of well-known American species, an initial step is taken here to bring *Hemichaena* and *Leucocarpus* into *Mimulus*. Other actions will be necessary, since the species identified as *Mimulus* sensu stricto are sister to the Australian clade. In case that it proves desirable to maintain the Australian segregate genera, and to maintain *Phryma* as a distinct genus, the suggestion by Beardsley and Barker (2005) to conserve the name *Mimulus* with a species from within the American lineage is being followed (Nesom and N. Fraga, in prep.). The much diminished *Mimulus* sensu stricto will then require a different name. Nesom and Fraga (in manuscript) also have substantially revised the infrageneric classification of American *Mimulus* in conjunction with preparation of the taxonomic treatment of the genus for the Flora of North America North of Mexico.

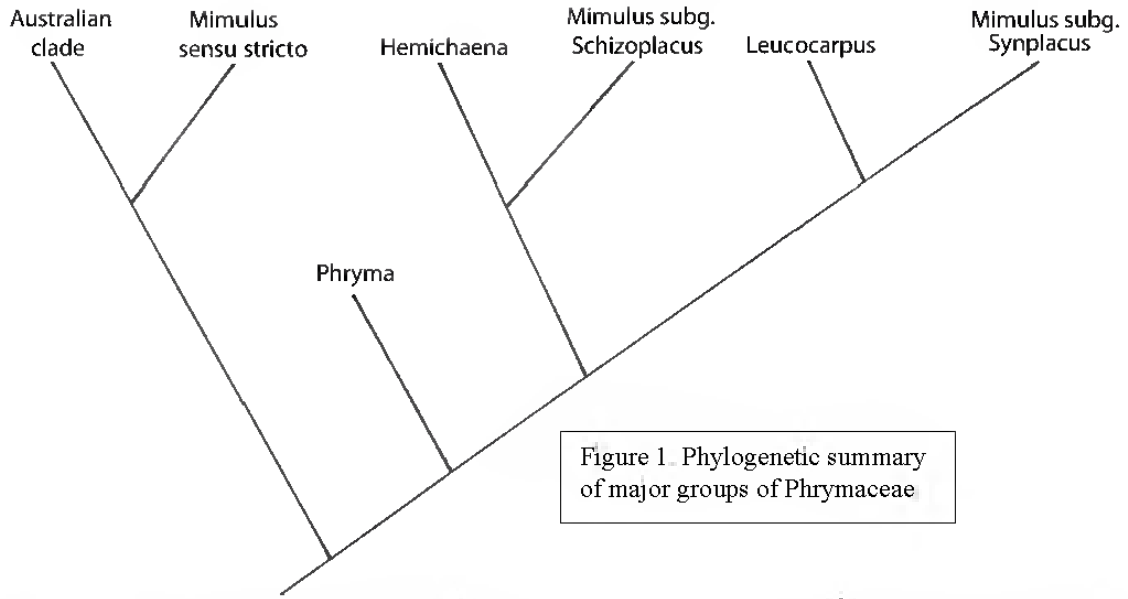

Figure 1. Phylogenetic summary of major groups of Phrymaceae.

The current concept of *Hemichaena* was formulated by Thieret (1955, 1972), who consolidated the species of *Berendtiella* Wettst. & Harms and *Hemichaena* — with the observation that they are "much alike in habit, habitat, vestiture, foliage, inflorescence, flowers, fruits, and seeds, all of which convince me that the taxa are congeneric" (1972, p. 89). His observations of their similarity followed those of Burtt (1965). Argue (1982) found that species of *Hemichaena* and *Berendtiella* could not be distinguished by pollen morphology, and further support for the close relationship of *Berendtiella* and *Hemichaena* has come from molecular-phylogenetic studies (Beardsley & Olmstead 2002; Beardsley et al. 2004, Oxelman et al. 2005; Xia et al. 2009).

Pennell (1935) placed *Berendtiella* along with *Mimulus* L. and the monotypic *Leucocarpus* D. Don in the Scrophulariaceae-Gratioleae, "because the flowers and especially the plate-like stigmas show a clear kinship to *Mimulus*" (p. 47). In an earlier treatment, however, Pennell (1920) had constituted the tribe Scrophulariaceae-Mimuleae with *Mimulus* and *Leucocarpus* (the treatment included only Colombian taxa). Burtt (1965) revived the Mimuleae, noting similarities among *Mimulus*, *Hemichaena*, and *Leucocarpus* in their bilamellate stigmas, campanulate to tubular 5-ribbed calyces, and loculicidal capsules.

Thieret (1967, p. 93) noted that "*Leucocarpus*, even though it possesses a baccate fruit, is obviously closely related to *Hemichaena* as is evidenced not only by its distinctive stigmas and calyx but also by its reticulate seeds with intra-reticular lines of a type apparently found nowhere else in the Scrophulariaceae except in these two genera." Slightly later, Thieret (1972) again recognized that floral characteristics of *Hemichaena* and *Leucocarpus* suggest an alliance with *Mimulus*, but he hypothesized on the basis of fruit and seed morphology that *Leucocarpus* is more distant and placed it as a relative of the Malaysian *Cyrtandromoea* Zoll. Interpretations of evidence from floral morphology are confirmed by the molecular data, which place *Leucocarpus* as sister to *Mimulus* subg. *Synplacus* — indicating that baccate fruits are a singular specialization evolved within this group of species that otherwise have capsular fruits.

Inflorescences of both *Hemichaena* and *Leucocarpus* tend to be bracteolate cymes, (consistently reduced in two species of *Hemichaena* to single flowers), while flowers of all species of American *Mimulus* are produced singly. The multiple-flowered inflorescences are distinctive but are reasonably interpreted as a primitive expression. Taxa closely related to *Mimulus-Hemichaena-*

Leucocarpus (Tank et al. 2006; Xia et al. 2009; Albach et al. 2009; Schäferhoff et al. 2010) — *Rehmannia*, *Triaenophora*, *Paulownia*, *Lancea*, and *Mazus* — usually produce flowers in racemes or a thyrse of cymes, sometimes reduced to axillary and solitary flowers in *Rehmannia*.

Apart from the inflorescence, *Hemichaena* is not distinct from *Mimulus* in any consistent features. Thieret (1972) emphasized the apparent distinction in *Hemichaena* of superposed inflorescences, which result from a bud and supernumerary bud in each leaf axil. Supernumerary buds, however, also occur in *M. gemmiparus* W.A. Weber (the proximal bud becomes a brood bulbil) and *M. guttatus* Fischer ex DC. (the proximal bud is dormant) (Beardsley 1997; Moody et al. 1999). The shrubby habit and revolute leaf margins of *Hemichaena* apparently evolved convergently or in parallel with species of *Mimulus* sect. *Diplacus*. Beardsley and Olmstead (2002) stated that "*Hemichaena* and *Berendtiella* have united placentae thus making divided placentae a synapomorphy for *Schizoplacus*" but Grant (1924) observed that *Hemichaena levigata* (as *Mimulus treleasei*, see next paragraph) is characterized by a separated placenta similar to species of sect. *Diplacus* (and all species of subg. *Schizoplacus*) — my observations support this for the other species of *Hemichaena* as well.

The clearly specialized, baccate fruits of *Leucocarpus* have a parallel, near-analog in those of the ten species of *Mimulus* sect. *Oenoe* (sensu Thompson 2005), where the capsules are initially indehiscent, opening along the inner suture after senescence of the plants and after being wet by fall or winter rains.

Species of *Mimulus* and Phrymaceae relatives are generally characterized by five major types of pollen morphology (Argue 1980, 1983, 1984, 1986; Chadwell et al. 1992). Pollen of both *Hemichaena* and *Leucocarpus* is tricolporate (type II), as is that of *Mimulus* subg. *Synplacus* (excluding sect. *Simiolus*, which has highly specialized and derivative type I). Pollen of *Mimulus* sensu stricto and some of the Australian clade also is tricolporate — *Glossostigma* has (3)4–6(–7)-colpate pollen; Barker 1982; Argue 1986) and *Peplidium* and *Microcarpaea* have tricolpate pollen (Argue 1986). Pollen of *Mimulus* subg. *Schizoplacus* (including sect. *Diplacus*) is tricolpate or stephanocolpate (types III, IV, and V). The pollen of *Phryma* is tricolpate, tectate-perforate to microreticulate, with simple columellae (type III). Tricolporate pollen is characteristic of close relatives of Phrymaceae (e.g., *Dodartia* L., *Lancea* J.D. Hook. & Thomson, *Mazus* Lour.; Argue 1984) and it appears to be the primitive type in Phrymaceae.

The morphological similarity of *Hemichaena* and *Leucocarpus* to *Mimulus* has been reflected in earlier species-level taxonomy. *Leucocarpus perfoliatus* (Kunth) Benth. was originally described by Kunth as *Mimulus perfoliatus*. *Hemichaena rugosa* (Benth.) Thieret was originally described by Bentham (1846) as *Diplacus rugosus* Benth. *Mimulus* sect. *Tropanthus*, as originally described by Grant (1924), included only the single species *M. treleasei* A.L. Grant, which is a synonym of *Hemichaena levigata* (returned to *Mimulus* as *M. levigatus*, as treated here). Grant (p. 325) noted that *M. treleasei* is "a peculiar species, combining the calyx characters of *Eumimulus* with the shrubbiness, the pubescent style, and the separated placentae of *Diplacus*." McMinn (1951, p. 114) observed a resemblance between *M. flemingii* Munz (= *Diplacus parviflorus* Greene) and *Berendtiella levigata* "in the configuration of the leaves and flowers" and admitted the possibility that *Diplacus*, which he treated at generic rank, and *Berendtiella* are derived from a common ancestor.

The geographic distribution of *Hemichaena* and *Leucocarpus* is primarily subtropical, but radiations in traditionally recognized *Mimulus* have produced species that occur within the geographic range of *Hemichaena* — *M. pachystylus* A.L. Grant (endemic to Chiapas; sect. *Paradanthus* fide Grant 1924) and *M. rupestris* Greene (endemic to Morelos; sect. *Erythranthe*).

Other species (e.g., *M. glabratus* Kunth and *M. guttatus* Fischer ex DC.) have ranges that extend from the western USA through Mexico and Central America to South America.

In summary, *Hemichaena* and *Leucocarpus* are both justifiably accomodated as groups within the bounds of *Mimulus* — each at the base of one or the other of the two major clades of the primarily western American species, subg. *Schizoplacus* and subg. *Synplacus*. This provides a first step toward retaining *Mimulus* as the generic name for these two subgenera, which together include about 140 species. If *Phryma* and Australian segregate genera of Phrymaceae are to be maintained, the next step is to conserve the name *Mimulus* with a species from within a western American group and adopt an alternative name for the four species of *Mimulus* sensu stricto.

MIMULUS sect. **LEUCOCARPUS** (D. Don) Nesom, comb. nov. **Leucocarpus** D. Don in Sweet, Brit. Flower Gard. ser. 2, 2: pl. 124. 1831. Type: *Conobea alata* Graham (= *Mimulus perfoliatus*).

Plants shrubs or suffrutescent perennial herbs, glabrous or subglabrous, eglandular. **Stems** 0.4–1.8(–2.5) m high, strongly 4-angled to shallowly winged. **Leaves** thickened, elliptic-oblanceolate to narrowly lanceolate or narrowly oblanceolate, 9–21(–28) cm x 1.3–4.2(–5.6) cm, margins closely serrate to serrate-dentate, basally auriculate-clasping and perfoliate. **Flowers** on short, bracteate pedicels in axillary, pedunculate cymes of (1–)2–7(–14). **Calyces** tubular-campanulate, 6–12 mm long. **Corollas** 15–22 mm long, deciduous, yellow or white with a yellow throat, bilabiate. **Fruits** baccate, 10–18 mm wide, white, with thin skin and with most of the substance of the fruit derived from the fleshy placenta, septicidally sulcate, indehiscent. **Chromosome number** apparently not reported.

A single species.

Mimulus perfoliatus Kunth, Nov. Gen. Sp. (quarto ed.) 2: 371. 1817 [1818]. *Leucocarpus perfoliatus* (Kunth) Benth., Prodr. (DC.) 10: 335. 1846. **TYPE: Colombia**. Crescit in Regno Novo-Granatensi, no date, *Humboldt & Bonpland s.n.* (holotype: P).

Conobea alata J. Graham, Edinburgh New Philos. J. 10: 168. 1830. *Leucocarpus alatus* (J. Graham) Benth., Brit. Flower Gard. ser. 2, 2: pl. 124. 1833[1831]. **TYPE: Mexico**. "This plant was raised in the garden of P. Neill, Esq. at Canonmill [Scotland], from Mexican seeds communicated by Mr. D. Don as a species of Conobea, and flowered in the greenhouse in Sept." (from the protologue).

Mimulus perfoliatus ranges from Mexico (Chiapas, Guerrero, Hidalgo, Jalisco, [Michoacan?], Oaxaca, Puebla, Querétaro, San Luis Potosí, Veracruz) and Central America (Panama, Nicaragua, Honduras, Guatemala) southward to South America (Bolivia, Colombia, Ecuador, Peru, Venezuela). It has been collected at elevations of 1500–10,200 feet.

MIMULUS sect. **TROPANTHUS** A.L. Grant, Ann. Missouri Bot. Gard. 11: 324. 1924. **TYPE**: *Mimulus treleasei* A.L. Grant (= *Mimulus levigatus*).

Hemichaena Benth., Pl. Hartw. 78. 1841. **TYPE**: *Hemichaena fruticosa* Benth. (= *Mimulus fruticosus*).

Berendtia A. Gray, Proc. Amer. Acad. Arts 7: 379. 1868 (non Goeppert 1845). *Berendtiella* Wettst. & Harms in Engler et Prantl, Nat. Pflanzenfam., Gesamtreg. 2-4: 459. 1899 [a replacement name for *Berendtia* A. Gray]. **LECTOTYPE** (Thieret 1972, p. 92): *Berendtia ghiesbrechtii* A. Gray (= *Mimulus rugosus*). Gray did not cite a type for his new genus, in which he included *B. ghiesbrechtii*, *B. coulteri*, and *B. rugosa*. Thieret cited *B. ghiesbrechtii* as the type.

Plants perennial, shrubs, stipitate-glandular or glabrous to vernicose. **Stems** woody, erect. **Leaves** pinnately nerved, margins slightly to strongly revolute. **Inflorescences** axillary cymes, solitary or superposed, 1–flowered or 2–12-flowered; pedicels shorter to slightly longer than the calyces. **Corollas** tubular, yellow to orange or red, sometimes with dotted throat, marcescent, bilabiate. **Anthers** glabrous, style pubescent. **Capsules** dehiscent halfway to completely to the base along both sutures, placentae separating completely or nearly so. **Chromosome number** apparently not reported.

1. Leaves auriculate-clasping; corollas yellow; stamens included ..... **Mimulus fruticosus**
1. Leaves short-petiolate to subsessile, bases cuneate to attenuate or acute, not clasping; corollas yellow to orange or red; stamens exserted (slightly so in *M. levigatus* and *M. rugosus*).

2. Stems and leaves glabrous, vernicose; petiole bases hardly swollen and indurate, blade margins prominently decurrent as stem wings; corollas orange to yellow ..... **Mimulus levigatus**
2. At least adaxial leaf surfaces stipitate-glandular; petiole bases swollen and indurate, persistent after abscission of the blade and upper petiole, blade margins not prominently decurrent; corollas yellow to orange or red.

3. Leaves 5–22 mm x 1–3(–5) mm; young stems densely hirtellous, eglandular, leaves stipitate-glandular adaxially; inflorescence usually terminal, bracteate; corollas yellow ..... **Mimulus spinulosus**
3. Leaves 20–80 mm x 10–35(–50) mm; young stems and both leaf surfaces stipitate-glandular; inflorescence of axillary flowers arising among large cauline leaves; corollas yellow to orange or red.

4. Corollas yellow, tube 13–15 mm long, included in or slightly longer than the calyx; stamens long-exserted ..... **Mimulus coulteri**
4. Corollas red to orange, tube 25–35 mm long, 2.5-3.5 times longer than the calyx, stamens slightly exserted ..... **Mimulus rugosus**

1. **Mimulus fruticosus** (Benth.) Nesom, comb. nov. *Hemichaena fruticosa* Benth., Pl. Hartw., 78. 1841. *Leucocarpus fruticosus* (Benth.) Benth., Prodr. (DC.) 10: 336. 1846. **LECTOTYPE** (designated here): **Guatemala**. Prope Quetzaltenango, 1840, *K.T. Hartweg 549* (K digital image!). Other very similar specimens cannot be assumed to be exact duplicates of the type because of differences in the date or collection number: 1839, *Hartweg 549* (LD digital image!); no date, *Hartweg 548* (BM digital image!); 1841, *Hartweg 548* (NY digital image!); 1840, *Hartweg 548* (PH not seen). The protologue cited only "Quetzaltenango."

Erect herbaceous, suffrutescent, or shrubby plants to 2 m, young stems and leaf surfaces stipitate-glandular. **Leaves** sessile, ovate or elliptic, sometimes narrowly so, 4–16 cm long, 1.5–5.5 cm wide, margins coarsely to finely toothed, usually less so or even entire toward the base, base slightly clasping to cordate-amplexicaul, sometimes slightly pandurate; petioles 0–1 mm long, bases swollen and indurate, persistent after abscission of the blade and upper petiole. **Inflorescence** axillary, arising among large cauline leaves; peduncles 1–12-flowered, to 4 cm long; pedicels to 20 mm long. **Calyces** 14–17 mm long. **Corollas** yellow, 2.5–3.2 cm long, tube 2 times longer than the calyx. **Stamens** included, anthers 3 mm long.

Roadsides and road banks, disturbed and open slopes, cliff faces, river banks, sandbars, rocky places, clay over limestone, oak-pine zones, pine forests, broadleaf cloud forest, evergreen cloud forest with *Quercus*, *Pinus*, *Abies*, *Drimys*, *Photinia*, *Clethra*, *Cornus*, and *Symplocos*; ca. 3000–11,500 ft; Oaxaca, Chiapas, Guatemala, Honduras, Nicaragua, Costa Rica, Panama.

The name "Hemichaena oaxacana" applied to a collection of *Mimulus fruticosus* at NY apparently was never published.

2. Mimulus levigatus (B. Rob. & Greenm.) Nesom, comb. nov. *Berendtia levigata* B. Rob. & Greenm., Proc. Amer. Acad. Arts 32: 39. 1897. *Hemichaena levigata* (B. Rob. & Greenm.) Thieret, Fieldiana, Bot. 34: 96. 1972. *Berendtiella levigata* (B. Rob. & Greenm.) Thieret, Ceiba 4: 305. 1955. **TYPE: Mexico. Puebla**. Calcareous ledges near Tehuacan, 5500 ft, 24 Dec 1895, *C.G. Pringle 6294* (holotype: US digital image!; isotypes: A, CAS digital image!, F digital image!, GH-2 sheets, K digital image!, MO digital image!, PH digital image!, US).

Mimulus treleasei A.L. Grant, Ann. Missouri Bot. Gard. 11: 325. 1924 [1925]. **TYPE: Mexico. Puebla**. Tehuacan, 2 Jun 1905, *W. Trelease 68* (holotype: MO digital image!).

Erect shrubs to 0.9 m, glabrous, vernicose especially in the younger parts. **Leaves** opposite or fascicled, sometimes clustered on spur shoots, elliptic, ovate, or rhombic, sometimes narrowly so, 1.5–5 cm long, 0.4–2.2 cm wide, margins usually revolute, entire to distally serrate with widely spaced teeth, base acute to attenuate, petioles 0–8 mm long, winged distally, petiole bases neither strongly swollen nor indurate. **Inflorescence** axillary, arising among large cauline leaves; peduncles 1–flowered, to 20 mm long; pedicels as peduncles. **Calyces** 9–15 mm long. **Corollas** reddish orange, 2.5–3.5 cm long, tube 3 times longer than the calyx. **Stamens** barely or not exserted, anthers 2–2.5 mm long.

Ledges and rocky soil, limestone slopes, matorral with *Morkillia mexicana*, *Erythroxylon compactum*, *Bursera glabrifolia*, *Sophora secundiflora*, *Krameria cytisoides*, *Hintonia latiflora*; ca. 5000–6000 ft; Oaxaca, Puebla, Veracruz.

3. Mimulus spinulosus (S. Wats.) Nesom, comb. nov. *Berendtia spimulosa* S. Wats., Proc. Amer. Acad. Arts 25: 159. 1890. *Hemichaena spmulosa* (S. Wats.) Thieret, Fieldiana, Bot. 34: 98. 1972. *Berendtiella spimulosa* (S. Wats.) Thieret, Ceiba 4: 305. 1955. **TYPE: Mexico. Nuevo León**. Dry limestone cliffs of the Sierra Madre near Monterey, 27 Jun 1888, *C.G. Pringle 1952* (holotype: US digital image!; isotypes: F digital image!, GH, K digital image!, USJ).

Erect, pendent, or trailing shrubs to 0.9 m, young stems and leaf surfaces stipitate-glandular. **Leaves** opposite or fascicled, elliptic, ovate, or obovate; sometimes narrowly so, 5–22 mm long, 1–3(–5) mm wide, margins entire to several toothed, teeth widely spaced, base acute to attenuate, petioles 1–2 mm long, bases swollen and indurate, persistent after abscission of the blade and upper petiole. **Inflorescence** usually terminal, bracteate; peduncles 1-flowered, to 10 mm long, sometimes persisting and "thornlike" on dead branches; pedicels as peduncles. **Calyces** 5–6.5 mm long. **Corollas** yellow, tube 13-18 mm long, 1.5–2 times longer than the calyx. **Stamens** exserted, anthers 0.7–1 mm long.

Outcrops, cliff faces, crevices, talus, slopes, arroyo banks, limestone, gypsum, cemented gravel, oak-pine forest, scrub-oak zone, oak chaparral with *Garrya-Rhus-Agave-Nolina-Pinus* or with *Dasylirion-Agave-Cercocarpus-Fraxinus greggii* and *Pinus*, matorral of *Acacia*, *Leucaena*, *Pistacia*, *Vauquelinia*, and *Dodonea*; ca. 2000–5000 ft; Coahuila, Nuevo León.

Collections in herbarium TEX-LL that have been recognized by the unpublished name "Mimulus cebollanus" are within the range of variation of *M. spimulosus*. Similarly, the name "Berendtiella pendens" applied to a collection of *M. spimulosus* at K apparently was never published.

4. Mimulus coulteri (A. Gray) Nesom, comb. nov. *Berendtia coulteri* Gray, Proc. Amer. Acad. Arts 7: 380. 1868. *Hemichaena coulteri* (A. Gray) Thieret, Fieldiana, Bot. 34: 94. 1972. *Berendtiella coulteri* (Gray) Thieret, Ceiba 4: 305. 1955. **TYPE: Mexico**. No other information, *T. Coulter 1335* (holotype: GH; isotype: K-2 sheets digital images!). A collection labeled as *Coulter 1334* (fide JSTOR) at K apparently is not an isotype.

Erect shrubs to 2 m, young stems and leaf surfaces stipitate-glandular. **Leaves** elliptic, (25–)30–80 mm x 15–35(–50) mm, margins entire to obscurely toothed or undulate, base acute to rounded, the apex acute to obtuse, petioles 1–2 mm, bases swollen and indurate, persistent after abscission of the blade and upper petiole. **Inflorescence** axillary, arising among large cauline leaves; peduncles 1–5-flowered, to 15 mm long; pedicels to 5 mm long. **Calyces** 5–8 mm long. **Corollas** yellow, tube 13–15 mm long, included in or slightly longer than the calyx. **Stamens** exserted, anthers 1.6–1.8 mm long.

Rocky or shale to clay or loam slopes, canyons, xerophytic matorral with juniper and oak, deciduous tropical forest, disturbed cloud forest with pine and juniper; ca. 4000–6000 ft.; Guanajuato, Hidalgo, Querétaro.

5. Mimulus rugosus (Benth.) Nesom, comb. nov. *Diplacus rugosus* Benth., Prodr. (DC.) 10: 368. 1846. *Hemichaena rugosa* (Benth.) Thieret, Fieldiana, Bot. 34: 96. 1972. *Berendtia rugosa* (Benth.) A. Gray, Proc. Amer. Acad. Arts 7: 380. 1868. *Berendtiella rugosa* (Benth.) Thieret, Ceiba 4: 305. 1955. **TYPE: Mexico. Chiapas**. "In Mexico australi in prov. Chiapas," *J.J. Linden 201* (holotype: K, fide Thieret 1972).

Berendtia ghiesbrechtii A. Gray, Proc. Amer. Acad. Arts 7: 380. 1868. **TYPE: Mexico. Chiapas**. *Ghiesbrecht & Berendt 134* (holotype: GH, fide Thieret 1972).

Erect, arching, or sometimes pendent shrubs to 4 m, young stems and both leaf surfaces stipitate-glandular. **Leaves** opposite or fascicled, ovate or elliptic, sometimes narrowly so, 20–70 mm long, 10–35 mm wide, margins coarsely to finely many to few toothed, the base cuneate to attenuate, petioles 1–7 mm long, bases swollen and indurate, persistent after abscission of the blade and upper petiole. **Inflorescence** axillary, arising among large cauline leaves; peduncles 1–3-flowered, to 15 mm long; pedicels to 12 mm long. **Calyces** 8–14 mm long. **Corollas** orange to red, tube 25–35 mm long, 2.5–3.5 times longer than the calyx. **Stamens** exserted, anthers 1.5–2 mm long.

Rocky slopes, ridges, cliff faces, roadsides and roadbanks, matorral, oak and pine-oak-juniper-arbutus woodlands; ca. 4600–10,000 ft; Chiapas, Guatemala, Honduras.

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CRATAEGUS COCCINEA VAR. *FULLERIANA* (SARGENT) J.A. MACKLIN & J.B. PHIPPS, COMB. ET STAT. NOV.

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The forthcoming treatment of *Crataegus* in Volume 9 of Flora of North America currently expected in late 2011 (Phipps, in press) necessitates a rank change for *C. fulleriana* (Sargent 1903) to bring it into conformity with the latest, but unformalized, views on this taxon in the first author's Ph.D. dissertation (Macklin 2001). In Macklin's primarily morphometric study, *C. coccinea* was treated broadly but with several more or less well-marked varieties. Most of these have 5–10 stamens but *C. fulleriana* has 20 and is otherwise rather like *C. coccinea* var. *pringlei* (Sargent) J.A. Macklin & J.B. Phipps both in leaf shape and tendency to convexity. *Crataegus fulleriana* was lectotypified by the current authors in 2002 (Macklin & Phipps 2002). More detail can be found in Macklin (2001) and FNA Volume 9.

Crataegus coccinea L. var. **fulleriana** (Sargent) J.A. Macklin & J.B. Phipps, comb. et stat. nov.
Crataegus fulleriana Sargent, Proc. Rochester Acad. Sci. 4: 111. 1903.

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NEW AND NOTEWORTHY ADDITIONS TO THE ARKANSAS FERN FLORA

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ABSTRACT

Since 1995, 11 fern taxa have been added to the Arkansas flora as new and native, including *Asplenum montanum*, *A. ruta-muraria*, *A. septentrionale*, *A. ×trudellii*, *Athyrium angustum*, *Azolla caroliniana*, *Dryopteris goldiana*, *D. celsa* × *goldiana*, *Marsilea macropoda*, *Palhinhaea cernua*, and *Trichomanes intricatum*. Of the reported Arkansas native ferns, one was deleted (*Azolla caroliniana*), being subsumed by *Azolla mexicana* and now correctly known as *Azolla microphylla*. Since 1995, 20 fern taxa have been added to the Arkansas fern flora as new and naturalized, including *Arachnioides simplicior*, *Athyrium nipponicum* 'Pictum', *Cyrtomium falcatum*, *C. fortunei*, *Dryopteris erythrospora*, *Hypolepis tenuifolia*, *Marsilea mutica*, *M. quadrifolia*, *Matteuccia struthiopteris*, *Nephrolepis exaltata*, *Polystichum tsus-sinense*, *Phegopteris decursive-pinnata*, *Salvinia minima*, *S. molesta*, *Selaginella braunii*, *S. kraussiana*, *S. k.* 'Aurea', *S. k.* 'Brownii', *S. k.* 'Goldtips', and *S. uncinata*. Of the reported Arkansas naturalized ferns, one was deleted (*C. fortunei*), being without a known voucher. There are now 97 native and 24 naturalized fern taxa known and documented in the Arkansas fern flora. The total Arkansas fern flora is now 121 taxa documented with 3019 county-level occurrence records. Noteworthy update records and comments are reported for 79 of 97 Arkansas native species and 25 Arkansas naturalized species.
KEY WORDS: Arkansas, ferns, county distribution

Over the last 30 years, studies have been conducted to document the diversity and abundance of the Arkansas fern [pteridophyte] flora. Taylor and Demaree (1979) presented a flora of 74 taxa with 1335 county-level occurrence records documented with herbarium citations and dot maps. Peck and Taylor (1995) presented a flora of 92 taxa with 2224 county-level occurrence records supported with dot maps. Since then a series of reports have provided updates on some of the new and noteworthy additions since Peck and Taylor (1995), including *Palhinhea cernua* (Bray 1996), *Salvinia minima* (Peck 1999, 2001; Peck & Serviss 2006), *Dryopteris goldiana* and *D. celsa x goldiana* (Peck, Witsell, & Hendrix 2000; Peck 2000), *Nephrolepis exaltata* (Peck 2002), *Azolla caroliniana*, *Cyrtomium falcatum* and *C. fortunei* (Peck 2003), and *Dryopteris erythrosora* and *Marsilea quadrifolia* (Simpson, Witsell, Crank, & Peck 2008; Serviss & Peck 2008). Even so, a large backlog of additions, range extensions, and noteworthy updates has accumulated for native and non-native taxa, making a new summary essential.

These increases reflect 1) improved knowledge of species apparently rare and local in Arkansas, 2) recognition of and searches for species that are difficult to separate from sister species, 3) continued targeting of species overlooked or under collected by general collectors, 4) continued field emphasis on moderated or sheltered rock house outcrops, timberland barrow pits, and wetland habitats, and 5) a concerted effort to examine and document fern cultivation as a potential source of adventives

that might escape and become naturalized. This report delineates and summarizes these additions. The Arkansas fern flora now consists of 121 taxa documented with 3019 county-level occurrence records.

NATIVE SPECIES

SOUTHERN MAIDENHAIR FERN – **Adiantum capillis-veneris** L. (Adiantaceae)—This fern was known from 28 counties in Arkansas (Peck & Taylor 1995) with a stronger presence in the Ozark Region than in the Ouachita Region. Two localities (Pulaski and Yell counties) in the Ouachita Region and one in the Ozark Region were added. This species is now known from 32 counties in Arkansas.

Voucher specimens: **ARKANSAS. Perry Co.**: *Peck 95127* (BRIT). **Pulaski Co.**: *Stephens 2002005* (BRIT). **Sharp Co.**: *Davis 5* (STAR). **Yell Co.**: *Peck 99507* (BRIT).

POWDERY CLOAK FERN -- **Argyrochosma dealbata** (Pursh) Windham (Pteridaceae)—
Previously known from 6 counties in northern Arkansas (Peck & Taylor 1995), three more counties are now known to support populations of this fern. This species is now known from 9 counties in Arkansas.

Voucher specimens: **ARKANSAS. Fulton Co.**: *Peck 2008700* (BRIT). **Marion Co.**: *Witsell 050128* (ANHC). **Madison Co.**: *Witsell 020753* (ANHC).

BRADLEY'S SPLEENWORT – **Asplenium bradleyi** D,C. Eaton (Aspleniaceae)—Known from 30 counties in Arkansas (Peck & Taylor 1995), 7 more Ozark Region counties in northeastern Arkansas were added. This species is now known from 37 counties in Arkansas.

Voucher specimens: **ARKANSAS. Clark Co.**: *Vearrier 292* (HEND). **Crawford Co.**: *Peck 86712* (BRIT). **Faulkner Co.**: *Peck 87742* (BRIT). **Lawrence Co.**: *Peck 86528* (BRIT). **Randolph Co.**: *Peck 86534* (BRIT). **Sebastian Co.**: *Peck 86720* (BRIT). Scott Co.: *Peck 86733* (BRIT). **Sharp Co.**: *Peck 86524* (BRIT). **White Co.**: *Engel sn* (HARD).

MOUNTAIN SPLEENWORT – **Asplenium montanum** Willd. (Aspleniaceae)—This species occurs east of the Mississippi River. In 1960 F. Dunlap collected the first specimen west of the Mississippi River in Montgomery Co., MO (Key & Redfearn 1973), a station now considered destroyed by road construction. A plant was discovered in 2002 growing on fractured novaculite in a deep ravine on the north side of Spanish Mountain in Garland Co., AR, and another in 2008 at a rock house environment along Sylamore Creek, Stone County, AR. Rock house environments simulate 'Tertiary' or 'Tropical' microclimatic moderation (Farrar, 1998) providing conditions that favor 'vegetational inertia' (Cole 1985) retain species longer at what now has become their peripheral or extra-limital range (Farrar 1992). This is the first report of the species for Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2008781* (BRIT). **Stone Co.**: *Peck 2008680* (BRIT).

LOBED SPLEENWORT – **Asplenium pinnatifidum** Nutt. (Aspleniaceae)—This species was formed from the hybrid of *A. rhizophyllum* × *montanum* (Wagner 1954), a cross that occurred many times over eastern USA (Werth, Guttman, & Eshbaugh 1985). The sterile hybrid [not known in nature] underwent a doubling of its chromosome number to become a fertile tetraploid species. Peck and Taylor (1995) reported it from nine counties. Another 15 counties are reported here. While the first parent is fairly

widespread across upland Arkansas, the second parent is not, suggesting that much of the presence of this species reflects spore dispersal from other tetraploid plants, rather than multiple origins from independent hybrid origins within Arkansas.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Peck 1997299* (BRIT). **Boone Co.**: *Peck 1997274* (BRIT). **Carroll Co.**: *Peck 1997261* (BRIT). **Fulton Co.**: *Peck 1996314* (BRIT). **Hot Spring Co.**: *Peck 1996479* (BRIT). **Johnson Co.**: *Johnson 5259* (APCR). **Logan Co.**: *Peck 1998117* (BRIT). **Madison Co.**: *Peck 1997240* (BRIT). **Marion Co.**: *Peck 1997283* (BRIT). **Montgomery Co.**: *Peck 86338* (BRIT). **Newton Co.**: *Peck 86409* (BRIT). **Polk Co.**: *Peck 98243* (BRIT). **Pope Co.**: *Peck 86420* (BRIT). **Randolph Co.**: *Peck 1998244* (BRIT). **Sharp Co.**: *Peck 1998299* (BRIT).

EBONY SPLEENWORT – **Asplenium platyneuron** (L.) Britton, Sterns, & Poggenburg (Aspleniaceae)—With this voucher, the species is known from all 75 counties in Arkansas.

Voucher specimen: **ARKANSAS. Cleveland Co.**: *Lunsford 19* (UAM).

BLACK-STEMMED SPLEENWORT – **Asplenium resiliens** Kunze (Aspleniaceae)—Known from 21 counties in the Ozark and Ouachita regions of Arkansas, although much more common to the north in the Ozark Region. To these another 9 counties were added with Clark, Hot Spring, Pike, Pulaski, and Saline counties in the Ouachita region. This species is now known from 30 counties in Arkansas.

Voucher specimens: **ARKANSAS. Clark Co.**: *Peck 86483* (BRIT). **Cleburne Co.**: *Peck 86467* (BRIT). **Hot Spring Co.**: *Peck 86477* (BRIT). **Johnson Co.**: *Johnson 5184* (APCR). **Pike Co.**: *Peck 86480* (BRIT). **Pope Co.**: *Peck 86338* (BRIT). **Pulaski Co.**: *Bullard 94* (BRIT). **Saline Co.**: *Witsell 010124* (ANHC). **Van Buren Co.**: *Peck 86453* (BRIT).

WALKING FERN – **Asplenium rhizophyllum** L. (Aspleniaceae)—Known from 17 counties in Taylor (1984) and 28 counties in Peck and Taylor (1995), this species common across the Ozark Region of Arkansas was subsequently collected in 6 Ouachita Region counties. This species is now known from 34 counties in Arkansas.

Voucher specimens: **ARKANSAS. Clark Co.**: *Peck 86484* (BRIT). **Garland Co.**: *Peck 2008622* (BRIT). **Hot Spring Co.**: *Peck 86478* (BRIT). **Montgomery Co.**: *Peck 2008439* (BRIT). **Pike Co.**: *Peck 86481* (BRIT). **Saline Co.**: *Pelton sn* (HEND).

WALL-RUE FERN – **Asplenium ruta-muraria** L. (Aspleniaceae)—This species in the USA is essentially east of the Mississippi River with western outliers in Iowa and Missouri. The core or metropolitan range is along the Appalachian Mountains wherein it is rare and local. Populations were recently discovered in eastern Ontario (Munro 1988), Labrador, and in eastern Iowa (Cady & Horton 2004). This species was reported spuriously from Arkansas for many decades by many authors citing past literature comments, but no voucher has been cited or found (Peck 2003). Taylor (1982) included it with a wonderful illustration by Paul W. Nelson in his Arkansas fern book in hopes that it might be found at some time in the future in the upper tier of Arkansas counties that contain limestone outcrops and proximity to known populations in the southern row of Missouri counties (Yatskievych 2000). The species was found growing on exposed limestone outcrops in Fulton Co., Arkansas, in 2002 and was still present 6 years later. This is the first vouchered Arkansas report for this species.

Voucher specimen: **ARKANSAS. Fulton Co.**: *Peck 2008701* (BRIT).

FORKED SPLEENWORT – **Asplenium septentrionale** (L.) Hoffmann (Aspleniaceae)—The species's metropolitan range is essentially the western USA with mid-continental periphery in western portions of South Dakota, Colorado, Oklahoma, and Texas with eastern outliers known from Monroe and Hardy counties in West Virginia (Bush 1986). Plants of this species were discovered in 2003 near the summit plateau on the northwest end of Magazine Mountain, Logan County, AR, some 400 km east of its occurrence in Texas. The fronds were embedded to nearly covered within Reindeer 'Moss' *Cladonia*, White Moss, *Leucobryum*, and Tree Moss, *Climacium americanum*, growing thickly on an acid, thin, clay-shale mineral soil overlaying sandstone bedrock within 5 m of the cliff face. This is the first Arkansas report for this species.

Voucher specimen: **ARKANSAS. Logan Co.**: *Peck 2008657* (BRIT).

MAIDENHAIR SPLEENWORT – **Asplenium trichomanes** L. subsp. **trichomanes** (Aspleniaceae)—Known from 33 counties in Arkansas, this species is reported from 6 more counties in the Ouachita (3) and Ozark (3) regions of Arkansas. This species is now known from 39 counties in Arkansas.

Voucher specimens: **ARKANSAS. Clark Co.**: *Peck 2009913* (BRIT). **Lawrence Co.**: *Peck 86528* (BRIT). **Pike Co.**: *Peck 2009903* (BRIT). **Randolph Co.**: *Peck 86534* (BRIT). **Saline Co.**: *Peck 2009918* (BRIT). **Sharp Co.**: *Peck 86534* (BRIT).

SCOTT'S SPLEENWORT – **Asplenium ×ebenoides** R.R. Scott [*A. platyneuron* × *rhizophyllum*] (Aspleniaceae)—This hybrid spleenwort occurs as both sterile or fertile plants, the latter having a doubled chromosome number and producing viable spores through normal meiosis (Walter, Wagner, & Wagner 1982), with fertile plants known only from Hale Co., Alabama. This hybrid is known from three counties in Arkansas (Peck & Taylor 1995). The plant was first discovered in Arkansas by David Johnson in 1979 at Haw Creek Falls, Pope Co. and was removed completely when vouchered. Searches in the 1980s, 90s, and in 2008 were not productive in an attempt to locate hybrid plants at this locality. The second population was discovered at a city park at Batesville, Independence Co., AR, and is somewhat protected. The third population, located at the top of East Mountain overlooking Gulpha Gorge, occurring at Hot Springs National Park, Garland Co., was still present in 2008. The first voucher taken in 1985 produced viable spores, while the most recent taken in 2008 did not. Thus, a mixed hybrid population might be present, similar to that at Hale Co., AL, requiring additional study.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 1985113, 1986333, 2008745* (BRIT). **Independence Co.**: *Smitt sn* (UAM). **Pope Co.**: *Johnson 7908* (HXC).

GRAVES' SPLEENWORT – **Asplenium ×gravesii** Maxon [*A. bradleyi* × *pinnatifidum*] (Aspleniaceae)—This rare hybrid was reported from Garland Co., AR, for the first time by Werth and Taylor (1980). Subsequently, an overlooked population in adjacent Montgomery County was discovered as an herbarium specimen, but a field search at Little Missouri Falls failed to locate plants (Peck & Taylor 1995). In 2004 a third location in a third county, 260 km to the north in the Leatherwood Wilderness Area of the Ozark National Forest, was discovered near Big Flat, Baxter Co., AR. The plant occurred on a fractured chert outcrop near the bottom of a 600 foot deep ravine 300 m distant from a rock breakdown with cool blowing air flow. The parent species were nearby. The plant has persisted 7 years at this location.

Voucher specimens: **ARKANSAS. Baxter Co**.: *Peck 2008696* (BRIT). **Garland Co.**: *Peck 1986332* (BRIT). **Montgomery Co**.: *Thomas 100549* (UAM).

TRUDELL'S SPLEENWORT – **Asplenium ×trudellii** Wherry [*A. montanum* × *pinnatifidum*] (Aspleniaceae)—This sterile triploid backcross hybrid is exceptional (Wagner 1954; Walter, Wagner, & Wagner 1982). It is found in significant populations that "must have some means of propagation although the spores are highly abortive and meiosis involves both univalents and bivalents." All other sterile triploid backcross hybrids are found sparingly with few plants evident. In 2005 a population was located in the Leatherwood Wilderness Area of the Ozark National Forest, being discovered at the bottom of a 600 feet ravine on breakdown rubble. The Arkansas population is the first discovered west of the Mississippi River, the closest in Illinois or Tennessee, some 400 km distant to the northeast or east. It is likely that the occurrence of this extra-limital plant is in part explained by the rockhouse-like microhabitat (Farrar 1998) affording some environmental inertia (Cole 1985) that simulates conditions to the north and east, protecting the plants from hot and dry summer conditions experienced in the uplands.

Voucher specimen: **ARKANSAS. Baxter Co**.: *Peck 2008693* (BRIT).

NORTHERN LADY FERN – **Athyrium angustum** (Willd.) G. Lawson (Dryopteridaceae)—This fern species was overlooked in Arkansas. It occurs throughout the upland counties of Arkansas mixed with the Southern Lady Fern *Athyrium aspentoides*. Both species were treated as varieties of *A. filix-femna* (Butters 1917) based on the perception that they are difficult to distinguish (Benedict 1934; Liew 1972). Yet they co-occur in mixed populations from Arkansas to Virginia and maintain their morphological differences. Based on allozymes and spore morphology, sufficient divergence exists between these taxa to warrant distinction at least to subspecies or species rank (Kelloff, Skog, Adamkewicz, & Werth 2002). Both taxa occur in Arkansas, yet only *A. asplenioides* has been reported previously. These 27 Arkansas county records extend the southwestern corner of the range by 300 km.

Voucher specimens: **ARKANSAS. Baxter Co**.: *Peck 2010082* (BRIT). **Boone Co.**: *Peck 2009569* (BRIT). **Carroll Co.**: *Peck 2010646* (BRIT). **Clark Co**.: *Peck 2009585* (BRIT). **Cleburne Co**.: *Peck 2009590* (BRIT). **Fulton Co**.: *Peck 2010081* (BRIT). **Garland Co**.: *Peck 2009581* (BRIT). **Hot Spring Co**.: *Peck 2009587* (BRIT). **Independence Co**.: *Peck 2010644* (BRIT). **Izard Co**.: *Peck 2010110* (BRIT). **Jackson Co.**: *Peck 2010645* (BRIT). **Johnson Co**.: *Peck 2009584* (BRIT). **Lawrence Co.**: *Peck 2010643* (BRIT). **Logan Co**.: *Peck 2009580* (BRIT). **Marion Co**.: *Peck 2009568* (BRIT). **Madison Co**.: *Peck 2009571* (BRIT). **Montgomery Co.**: *Peck 2009582* (BRIT). **Newton Co**.: *Peck 2009570* (BRIT). **Pike Co**.: *Peck 2009586* (BRIT). **Polk Co.**: *Peck 2009583* (BRIT). **Pope Co**.: *Peck 2009566* (BRIT). **Randolph Co**.: *Peck 2010642* (BRIT). **Searcy Co.**: *Peck 2009567* (BRIT). **Sharp Co.**: *Peck 2010641* (BRIT). **Stone Co.**: *Peck 2010080* (BRIT). **White Co**.: *Peck 2009589* (BRIT).

MOSQUITO FERN – **Azolla microphylla** Kaulf. (Azollaceae)— All Arkansas material (Peck and Taylor 1995) was traditionally referred to as *Azolla mexicana* C. Presl until recently when some specimens were assigned to *A. carolmiana* Willd. (Peck 2003). Recent herbarium and molecular studies (Mickel and Smith 2004, Reid, Plunkett, & Peters 2006) showed that *Azolla microphylla was* a valid, older name than *A. mexicana* and that it was conspecific with *A. carolmiana*. Thus, all material from Arkansas is now reported as *A. microphylla*. The species is known from 60 of Arkansas's 75 counties, almost to the exclusion of the northern two rows of upland counties.

Voucher specimens: **ARKANSAS. Ashley Co.**: *Peck 2009223* (BRIT). **Bradley Co.**: *Roberts 17* (BRIT). **Chicot Co.**: *Thomas 163744* (BRIT). **Cleburne Co.**: *Peck 2010006* (BRIT). **Cleveland Co.**: *Smith 17* (BRIT). **Columbia Co.**: *Markson 84* (BRIT). **Cross Co.**: *Peck 2010028* (BRIT). **Dallas Co.**: *Smith 5* (BRIT). **Drew Co.**: *Demaree 17625* (BRIT). **Grant Co.**: *Smith 29* (BRIT). **Howard Co.**: *Sweet 6* (BRIT). **Lafayette Co.**: *Sweet 12* (BRIT). **Little River Co.**: *Sweet 24* (BRIT). **Miller Co.**: *Lipscomb 2064* (BRIT). **Nevada Co.**: *Dorcas 12* (BRIT). **Ouachita Co.**: *Thomas 6673* (BRIT). **Pike Co.**: *Rogers 12* (BRIT). **Poinsett Co.**: *Peck 2010018* (BRIT). **Polk Co.**: *Peck 2010065* (BRIT). **Saline Co.**: *Neal 12* (BRIT). **Scott Co.**: *Peck 2010067* (BRIT). **Sevier Co.**: *Dorcas 41* (BRIT). **Van Buren Co.**: *Peck 2010005* (BRIT). **White Co.**: *Roberts 55* (BRIT). **Woodruff Co.**: *Roberts 85* (BRIT).

DISSECTED GRAPEFERN – **Botrychium dissectum** Sprengel f. **dissectum** (Ophioglossaceae)—This form was first reported from Arkansas by Buchholz and Palmer (1926). This form is more distinct and easier to distinguish than it is to separate the species of Grape Ferns from each other. McCauley, Whittier, and Reilly (1985) studied the inbreeding and self-fertilization of this species, while Montgomery (1990) studied the constancy of frond morphology and survivorship and predations changes of five populations in Pennsylvania. Barker and Hauk (2003) commented on molecular markers and the systematics of this and allied species. The form is far more common and abundant in the upper Midwest. While far less common than the non-skeletonized typical frond plants in Arkansas, plants with skeletonized form appear in about 5% of the populations and range from 1% to 20% of local plants. In the Ozark Region the form favors lowland woods, floodplain terraces, and areas that retain water for a week or more in swamp conditions. These wetter habitats have a soil high in humus often over a somewhat impervious mineral layer or clay. With the following 20 records, this fern is now known from 25 counties in Arkansas.

Voucher specimens: **ARKANSAS. Boone Co.**: *Peck 2000146* (BRIT). **Carroll Co.**: *Peck 2000138* (BRIT). **Conway Co.**: *Peck 2009409* (BRIT). **Crawford Co.**: *Peck 2009391* (BRIT). **Fulton Co.**: *Peck 200078* (BRIT). **Garland Co.**: *Peck 1996372* (BRIT). **Izard Co.**: *Peck 200083* (BRIT). **Johnson Co.**: *Kirshberger 102* (UAM). **Lawrence Co.**: *Peck 20000118* (BRIT). **Madison Co.**: *Wages sn* UCAC). **Marion Co.**: *Peck 2000114* (BRIT). **Perry Co.**: *Peck 2009399* (BRIT). **Polk Co.**: *Ewing sn* BRIT). **Pope Co.**: *Peck 2009403* (BRIT). **Randolph Co.**: *Peck 2000211* (BRIT). **Scott Co.**: *Peck 2009395* (BRIT). **Searcy Co.**: *Peck 2000096* (BRIT). **Sebastian Co.**: *Peck 2009393* (BRIT). **Sharp Co.**: *Peck 2000101* (BRIT). **Yell Co.**: *Peck 2009397* (BRIT).

OBLIQUE DISSECTED GRAPEFERN – **Botrychium dissectum** Sprengel f. **obliquum** (Muhl.) Fern. (Ophioglossaceae)—With this voucher, the non-dissected form is known from all 75 counties of Arkansas.

Voucher specimen: **ARKANSAS. Madison Co.**: *Wirges sn* (UCAC).

ALABAMA LIP FERN – **Cheilanthes alabamense** (Buckl.) Kunze (Pteridaceae)—This species is now known from 13 counties in Arkansas, with all but one county in the Ozark Region. The Saline County collection by Theo Witsell is the second county report for the Ouachita Region. With these 2 vouchers the species is now known from 15 counties in Arkansas.

Voucher specimens: **ARKANSAS. Independence Co.**: *Davis 2448* (APCR). **Saline Co.**: *Witsell 01-0223* (BRIT).

SLENDER LIP FERN – **Cheilanthes feei** Moore (Pteridaceae)—Once only known from 11 counties in Arkansas (Taylor 1984), subsequently reported from 14 counties (Peck & Taylor 1995), and now reported from a total of 20 counties. Significantly, to the one Ouachita Region county (Garland), vouchers from Clark, Montgomery, and Hot Spring counties were added.

Voucher specimens: **ARKANSAS. Clark Co.**: *Peck 2009461* (BRIT). **Cleburne Co.**: *Peck 2009605* (BRIT). **Garland Co.**: *Scully sn* (HSNP), *Letterman sn* (MO). **Hot Spring Co.**: *Peck 2009455* (BRIT). **Montgomery Co.**: Thomas 100549 (NLU). **Sharp Co.**: *Crank 02004* (BRIT).

HAIRY LIP FERN – **Cheilanthes lanosa** (Michx.) D.C. Eaton (Pteridaceae)—This species is now known from 33 counties in Arkansas.

Voucher specimen: **ARKANSAS. Saline Co.**: *Tucker 6464* (APCR).

WOOLLY LIP FERN – **Cheilanthes tomentosa** Link (Pteridaceae)—With these 3 peripheral county vouchers, the range in Arkansas of this species now includes 34 counties.

Voucher specimens: **ARKANSAS. Fulton Co.**: *Peck 200150* (BRIT). **Independence Co.**: *Smith s.n.* (LYON). **Saline Co.**: *Peck 200089* (BRIT).

BULBLET FRAGILE FERN – **Cystopteris bulbifera** (L.) Bernh. (Dryopteridaceae)—This species is noted for its vegetative propagation from leaf bulblets that abscise and form new plants. The species favors limestone or dolomite cliffs and calcareous sandstone and shales. Nineteen counties, mainly in the Ozark Region, were known to support populations of this species (Peck & Taylor 1995). Six more Ozark counties were added. This species is now known from 25 counties in Arkansas.

Voucher specimens: **ARKANSAS. Cleburne Co.**: *Peck 1999570* (BRIT). **Crawford Co.**: *Peck 2010079* (BRIT). **Franklin Co.**: *Peck 2020074* (BRIT). **Lawrence Co.**: *Peck 2010008* (BRIT). **Randolph Co.**: *Peck 2010074* (BRIT). **Sebastian Co.**: *Peck 2010076* (BRIT).

SOUTHERN FRAGILE FERN – **Cystopteris protrusa** (Weatherby) Blasdell (Dryopteridaceae)—
The protruding rhizome separates this species from other *Cystopteris*. This species favors the toe slope of moist, north-facing slopes with high humus soil. The species was known from 39 counties in Arkansas (Peck & Taylor 1995) with another 19 counties reported here. This species is now known from 58 counties in Arkansas.

Voucher specimens: **ARKANSAS. Boone Co.**: *Peck 1999118* (BRIT). **Clark Co.**: *Peck 2010063* (BRIT). **Clay Co.**: *Peck 2010011* (BRIT). **Cleburne Co.**: *Peck 1999576* (BRIT). **Crawford Co.**: *Peck 1986821* (BRIT). **Cross Co.**: *Peck 2010030* (BRIT). **Faulkner Co.**: *Peck 2010004* (BRIT). **Franklin Co.**: *Peck 1986812* (BRIT). **Fulton Co.**: *Peck 1988314* (BRIT). **Hempstead Co.**: *Witsell 07113* (ANHC). **Izard Co.**: *Peck 198812* (BRIT). **Jackson Co.**: *Peck 2010023* (BRIT). **Lee Co.**: *Peck 2010037* (BRIT). **Marion Co.**: *Peck 1988324* (BRIT). **Perry Co.**: *Peck 2010070* (BRIT). **Pulaski Co.**: *Peck 2010002* (BRIT). **Saline Co.**: *Carneal 120* (BRIT). **Sebastian Co.**: *Peck 1986944* (BRIT). **Yell Co.**: *Peck 1998074* (BRIT).

TENNESSEE BLADDER FERN – **Cystopteris tennesseensis** Shaver (Dryopteridaceae)—
Shaver (1950) first recognized this allotetraploid as distinct from other *Cystopteris* with many of its features intermediate between its parents (Moran 1982; Haufler, Windham, & Ranker 1990). This

species is common across the Ozark Region and was known from 29 counties in Arkansas (Peck & Taylor 1995). Another 13 counties are reported here. This species is now known from 42 counties in Arkansas.

Voucher specimens: **ARKANSAS. Cleburne Co.**: *Peck1999574* (BRIT). **Crawford Co.**: *Peck 1986820* (BRIT). **Faulkner Co.**: *2009412* (BRIT). **Franklin Co.**: *Peck 1986811* (BRIT). **Garland Co.**: *Peck 2009425* (BRIT). **Perry Co.**: *Peck 2009408* (BRIT). **Polk Co.**: *Peck 1986807* (BRIT). **Pulaski Co.**: *Peck 2009431* (BRIT). **Saline Co.**: *Peck 2009435* (BRIT). **Searcy Co.**: *Taylor 2576* (UARK). **Sebastian Co.**: *Peck 1986943* (BRIT). **White Co.**: *Peck 2009418* (BRIT). **Yell Co.**: 1998082 (BRIT).

MacKay's Fragile Fern – **Cystopteris tenuis** (Michx.) Desv. (Dryopteridaceae)—Although first recognized in 1889 as a variety (Blasdell 1963), Lellinger (1981), Moran (1983) and Haufler and Windham (1991) clarified that this *Cystopteris* is a tetraploid species formed as a result of hybridization between *C. protrusa* and another unknown *Cystopteris*. Overlooked in Arkansas until Peck and Taylor (1995) reported it based on herbaria specimens from two counties in the Ozark Region, the species was since documented from an additional 28 counties in the Ozark and Ouachita regions of Arkansas. This species is now known from 30 counties in Arkansas.

Voucher specimens: **ARKANSAS. Baxter** Co.: *Peck 1999150* (BRIT). **Benton Co.**: *Witsell 010801* (ANHC). **Boone Co.**: *Peck 1999120* (BRIT). **Carroll Co.**: *1999134* (BRIT). **Cleburne Co.**: *Peck 2002014* (BRIT). **Conway Co.**: *Peck 2009410* (BRIT). **Faulkner Co.**: *Peck 2009411* (BRIT). **Franklin Co.**: *Peck 1986816* (BRIT). **Fulton Co.**: *Peck 1999225* (BRIT). **Garland Co.**: *Peck 2009424* (BRIT). **Independence Co.**: *Peck 2000125* (BRIT). **Izard Co.**: *Peck 2000256* (BRIT). **Johnson Co.**: *Peck 1996224* (BRIT). **Logan Co.**: *Peck 2009380* (BRIT). **Madison Co.**: *Peck 1999194* (BRIT). **Marion Co.**: *Peck 198826* (BRIT). **Montgomery Co.**: *Peck 2009381* (BRIT). **Newton Co.**: *Peck 1996217* (BRIT). **Perry Co.**: *Peck 2009409* (BRIT). **Pope Co.**: *Peck 1996234* (BRIT). **Pulaski Co.**: *Peck 2009430* (BRIT). **Randolph Co.**: *Peck 2010233* (BRIT). **Searcy Co.**: *Peck 1996412* (BRIT). **Sharp Co.**: *Peck 201105* (BRIT). **Stone Co.**: *Peck 1996441* (BRIT). **Van Buren Co.**: *Peck 1996462* (BRIT). **White Co.**: *Peck 2009419* (BRIT). **Yell Co.**: *Peck 2009380* (BRIT).

Hybrid Fragile Fern – **Cystopteris bulbifera × tennesseensis** (Dryopteridaceae)—Two specimens of this hybrid were reported by Haufler, Windham and Ranker (1991) for Arkansas from Independence and Newton counties, to which one more county record was added. This hybrid is now known from three counties in Arkansas.

Voucher specimens: **ARKANSAS. Independence Co.** *Thomas 8673* fide Moran (TENN). **Newton Co.**: *Iltis 499* fide Haufler (UARK). **Stone Co.**: *Taylor 2895* fide Peck (UARK).

Hay-scented Fern – **Dennstaedtia punctilobula** (Michx.) Moore (Dennstaedtiaceae)—
Originally discovered in Arkansas by E. J. Palmer (1924) at the top of Magazine Mountain, Logan Co., the population is disjunct from its metropolis or species core to the east and north east. The species is now known from 4 counties in Arkansas, with 2 in the Ozark Region north of the Arkansas River and 2 in the Ouachita Region south of the Arkansas River.

Voucher specimen: **ARKANSAS. Logan Co.**: *Taylor 1046* (SIU), **Montgomery Co.**: (*Oleson 8701* (UARK), **Stone Co.**: Moore 450729 (UARK), **White Co.**: *Speer 386* (UARK).]

SILVERY GLADE FERN – **Deparia acrostichoides** (Swartz) Kato (Dryopteridaceae)—Once known from 8 counties in Arkansas (Peck & Taylor 1995). Four county vouchers are reported here, with two in the Ozark Region and two in the Ouachita Region of Arkansas. This species is now known from 12 counties in Arkansas with four counties in the Ouachita Region and eight counties in the Ozark Region.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Peck 99407* (BRIT). **Garland Co.**: *Crank 95005* (HEND). **Montgomery Co.**: *Marsh 95004* (HEND). **Stone Co.**: *Hendrix sn* (BRIT).

CROWFOOT CLUBMOSS – **Diphasiastrum digitatum** (Lycopodiaceae)—Once known only from 5 counties in Arkansas (Taylor 1984). Peck and Taylor (1995) reported it from 8 counties. With the additional vouchers reported here, the species is now known from 16 counties in Arkansas.

Voucher representations: **ARKANSAS. Baxter Co.**: Peck 99407 (BRIT). **Montgomery Co.**: *Witsell sn* (BRIT). **Newton Co.**: *Crank 08001* (BRIT). **Ouachita Co.**: *Witsell 06500* (ANHC). **Pope Co.**: *Parson sn* (BRIT). **Saline Co.**: *Witsell 07397* (ANHC). **Van Buren Co.**: *Witsell 07014* (ANHC). **Yell Co.**: *Saugey sn* (BRIT).

NARROW-LEAVED GLADE FERN – **Diplazium pycnocarpon** (Michx.) Desv. (Dryopteridaceae)—With this voucher, the species is now known from 22 counties in Arkansas with one county in the Ouachita Region, two along Crowley's Ridge in the east, and 19 Ozark counties.

Voucher specimen: **ARKANSAS. Izard Co.**: *McWilliams 29* (UCAC).

LOUISIANA WOOD FERN – **Dryopteris ludoviciana** (Kunze) Small (Dryopteridaceae)—First discovered in southeastern Arkansas in 1982 at Warren Prairie in Bradley Co. (Sundell, McIntyre, & Peck 1984). Two subsequent discoveries in southwestern Arkansas have raised its known range to 3 counties. The Bradley Co. population was lost to an arson fire.

Voucher specimens: **ARKANSAS. Bradley Co.**: *Peck 84642* (BRIT). **Lafayette Co.**: *Witsell 05036* (ANHC). **Miller Co.**: *Peck 2009177* (BRIT).

GOLDIE'S WOOD FERN – **Dryopteris goldiana** (Hooker ex Goldie) A. Gray (Dryopteridaceae)—The genus *Dryopteris* is well represented in the Arkansas flora with widespread species to rare and local disjunct outliers restricted to hillside seeps or within deep ravines with protected, shaded, north-facing rock outcrops and rockhouses (Peck & Peck 1988; Peck 2000). This species was first reported from Arkansas (Peck, Witsell, & Hendrix 2000) from Baxter Co. in northern Arkansas. Since then, additional populations were discovered in Baxter Co. and three adjacent counties in rugged terrain at the base of steep north-facing slopes. These stations have moderated (more northern-like microclimates) conditions, much like cliff rock houses (Farrar 1998) that provide a strong measure of vegetational inertia (Cole 1985) allowing these plants to persist well to the south and west of the core or metropolis of its range (Werth 1991). The species is now known from four counties in Arkansas.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Peck 99417, 2010082* (BRIT). **Fulton Co.**: *Peck 2010081* (BRIT). **Izard Co.**: *Peck 2010110* (BRIT). **Stone Co.**: *Peck 2010080* (BRIT).

SOUTHERN HYBRID WOOD FERN – **Dryopteris ×australis** (Wherry) Small (Dryopteridaceae) [*D. goldiana* × *ludoviciana*]—This hybrid was known earlier from two counties, Garland and Montgomery, in Arkansas (Peck 2000). Two additional counties were added subsequently and are

reported here (Peck, Witsell, & Hendrix 2000). This hybrid is now known from four counties in Arkansas.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Peck 99701* (BRIT). **Garland Co.**: *Peck 84680* (BRIT). **Montgomery Co.**: *Peck 95096* (BRIT). **Polk Co.**: *Peck 99513* (BRIT).

LEEDS' HYBRID WOOD FERN, PALMER WOOD FERN – **Dryopteris ×leedsii** Wherry (Dryopteridaceae) [*D. celsa* × *marginalis*]—This enigmatic *Dryopteris* was discovered in Van Buren Co. by E.J. Palmer in 1928, which led to 13 names being applied incorrectly to this plant. The fern was "lost" and then rediscovered by W. Carl Taylor (1982) in 1974 at the original location as noted on all herbarium specimens from the 1920s and 1930s by Delzie Demaree (Wagner & Taylor 1976). A second locality was discovered in Baxter Co. (Peck, Witsell, & Hendrix 2000, Peck 2000). This rare hybrid is now known from two counties in Arkansas.

Voucher specimen: **ARKANSAS. Baxter Co.**: *Peck 99704* (BRIT). **Van Buren Co.**: *Peck 99130* (BRIT).

Dryopteris celsa × goldiana (Dryopteridaceae)—This rare *Dryopteris* hybrid new to the Arkansas flora was discovered in Baxter Co. in northern Ozark Region of Arkansas (Peck, Witsell, & Hendrix 2000; Peck 2000). It still is known but from one location.

Voucher specimen: **ARKANSAS. Baxter Co.**: *Peck 99513* (BRIT).

FIELD HORSETAIL – **Equisetum arvense** L. (Equisetaceae)—This species was previously known from 12 counties in Arkansas in the Ozark and Crowley's Ridge regions. Here, a single, isolated population of this species was noticed where a timber access road had undergone extensive rehabilitation causing considerable disturbance. This is the first report of this species in the Ouachita Region and this far south in Arkansas. It is very likely that it was unintentionally brought into the site on road construction equipment.

Voucher specimen: **ARKANSAS. Garland Co.**: *Peck 20071535* (BRIT).

COMMON SCOURINGRUSH – **Equisetum hyemale** L. (Equisetaceae)—With these 16 county vouchers, the presence of this species was documented in all 75 Arkansas counties.

Voucher specimens: **ARKANSAS. Ashley Co.**: *Roberts 61* (BRIT). **Bradley Co.**: *Roberts 83* (BRIT). **Calhoun Co.**: *Roberts 27* (BRIT). **Cleveland Co.**: *Markson 117* (BRIT). **Columbia Co.**: *Markson 82* (BRIT). **Dallas Co.**: *Russell sn* (UAM). **Grant Co.**: *Sweet 8* (BRIT). **Howard Co.**: *Sweet 4* (BRIT). **Little River Co.**: *Sweet 22* (BRIT). **Miller Co.**: *Sweet 31* (BRIT). **Nevada Co.**: *Dorcas 8* (BRIT). **Ouachita Co.**: *Dorcas 12* (BRIT). **Pike Co.**: *Dorcas 32* (BRIT). **St. Francis Co.**: *Thomas 131316* (UAM). **Sevier Co.**: *Dorcas 46* (BRIT). **Woodruff Co.**: *Roberts 87* (BRIT).

FERRIS'S SCOURINGRUSH – **Equisetum ×ferrissii** Clute [*E. hyemale* × *laevigatum*] (Equisetaceae)—This hybrid scouringrush was thought to be rare and local across Arkansas, occurring in association with *Equisetum hyemale*, one of its parents. It is now evident that it is far more common and widespread. The hybrid occurs in various disturbed habitats, being particularly favored along waterways in thickets on sandy soils. Characters to separate the hybrid from its species are well

described in Rutz and Farrar (1984). With these 61 county vouchers, the hybrid is now documented in all 75 Arkansas counties.

Voucher specimens: **ARKANSAS. Ashley Co.**: *Peck 2010224* (BRIT). **Baxter Co.**: *Peck 2010200* (BRIT). **Bradley Co.**: *Peck 2010226* (BRIT). **Calhoun Co.**: *Peck 2010177* (BRIT). **Carroll Co.**: *Peck 2010203* (BRIT). **Chicot Co.**: *Peck 2010176* (BRIT). **Clark Co.**: *Peck 2010188* (BRIT). **Cleburne Co.**: *Peck 2010154* (BRIT). **Cleveland Co.**: *Peck 2010178* (BRIT). **Columbia Co.**: *Peck 2010181* (BRIT). **Conway Co.**: *Peck 2010193* (BRIT). **Craighead Co.**: *Peck 2010158* (BRIT). **Crawford Co.**: *Peck 2010197* (BRIT). **Crittenden Co.**: *Peck 2010167* (BRIT). **Cross Co.**: *Peck 2010162* (BRIT). **Dallas Co.**: *Peck 2010179* (BRIT). **Desha Co.**: *Peck 2010175* (BRIT). **Drew Co.**: *Peck 2010225* (BRIT). **Faulkner Co.**: *Peck 2010152* (BRIT). **Franklin Co.**: *Peck 2010195* (BRIT). **Fulton Co.**: *Peck 2010199* (BRIT). **Garland Co.**: *Peck 2010221* (BRIT). **Grant Co.**: *Peck 2010219* (BRIT). **Greene Co.**: *Peck 2010216* (BRIT). **Hempstead Co.**: *Peck 2010183* (BRIT). **Hot Spring Co.**: *Peck 2010221* (BRIT). **Howard Co.**: *Peck 2010186* (BRIT). **Izard Co.**: *Peck 2010201* (BRIT). **Jackson Co.**: *Peck 2010164* (BRIT). **Lafayette Co.**: *Peck 2010228* (BRIT). **Lawrence Co.**: *Peck 2010155* (BRIT). **Lee Co.**: *Peck 2010169* (BRIT). **Lincoln Co.**: *Peck 2010174* (BRIT). **Little River Co.**: *Peck 2010213* (BRIT). **Logan Co.**: *Peck 2010210* (BRIT). **Lonoke Co.**: *Peck 2010218* (BRIT). **Madison Co.**: *Peck 2010214* (BRIT). **Miller Co.**: *Peck 2010184* (BRIT). **Mississippi Co.**: *Peck 2010159* (BRIT). **Monroe Co.**: *Peck 2010170* (BRIT). **Montgomery Co.**: *Peck 2010222* (BRIT). **Nevada Co.**: *Peck 2010182* (BRIT). **Ouachita Co.**: *Peck 2010180* (BRIT). **Perry Co.**: *Peck 2010192* (BRIT). **Pike Co.**: *Peck 2010187* (BRIT). **Poinsett Co.**: *Peck 2010160* (BRIT). **Pope Co.**: *Peck 2010211* (BRIT). **Prairie Co.**: *Peck 2010171* (BRIT). **Randolph Co.**: *Peck 2010156* (BRIT). **St. Francis Co.**: *Peck 2010168* (BRIT). **Saline Co.**: *Peck 2010223* (BRIT). **Scott Co.**: *Peck 2010190* (BRIT). **Searcy Co.**: *Peck 2010206* (BRIT). **Sebastian Co.**: *Peck 2010196* (BRIT). **Sevier Co.**: *Peck 2010185* (BRIT). **Sharp Co.**: *Peck 2010215* (BRIT). **Stone Co.**: *Peck 2010198* (BRIT). **Union Co.**: *Peck 2010227* (BRIT). **Van Buren Co.**: *Peck 2010153* (BRIT). **White Co.**: *Peck 2010217* (BRIT). **Woodruff Co.**: *Peck 2010165* (BRIT). **Yell Co.**: *Peck 2010150* (BRIT).

SMOOTH SCOURINGRUSH – **Equisetum laevigatum** A. Br. (Equisetaceae)—This species was discovered in Arkansas for the first time in 1982 by the author from Sebastian County at the western edge of Arkansas (Taylor 1984). Additional field work along sandy islands, dredge spoil, and sandy terraces of the Arkansas River in the Arkansas valley from Fort Smith to Little Rock has led to the discovery of 5 more stations; a seventh station was found in a roadside ditch adjacent to pastured prairie in extreme northwest Arkansas. Additional populations might occur along the Arkansas River downstream from Little Rock. The species is now known from seven counties in Arkansas.

Voucher specimens: **ARKANSAS. Benton Co.**: *Peck 2009670* (BRIT). **Franklin Co.**: *Peck 2009578* (BRIT). **Johnson Co.**: *Peck 2009577* (BRIT). **Logan Co.**: *Peck 2009579* (BRIT). **Pulaski Co.**: *Peck 2006876* (BRIT). **Sebastian Co.**: *Peck 1982357*, *2009580* (BRIT). **Yell Co.**: *Peck 2009576* (BRIT).

SHINING CLUBMOSS – **Huperzia lucidula** (Michx.) Trevisan (Lycopodiaceae)—Arkansas populations are the most southwesterly in the North American range of this species, being disjunct for over 400 km from populations to the north and east. This species is now known from six Ozark Region counties in Arkansas (Peck & Taylor 1995) with the most recent addition being from Baxter Co.

Voucher specimen: **ARKANSAS. Baxter Co**.: *Hendrix sn* (BRIT). **Franklin Co**.: *Peck 96396* (BRIT). **Johnson Co**.: *Peck 96348* (BRIT). **Madison Co**.: *Peck 96414* (BRIT). **Newton Co**.: *Peck 96307* (BRIT). **Stone Co**.: *Peck 81176* (BRIT).

BUTLER'S QUILLWORT – **Isoetes butleri** Engelmann (Isoetaceae)—Once known from 11 counties (Taylor 1984), subsequently raised to 24 counties (Peck & Taylor 1995), now known from 41 counties widely spread across the Ozark and Ouachita regions.

Voucher specimens: **ARKANSAS. Boone Co**.: *Peck 98044* (BRIT). **Clark Co**.: *Peck 2010062* (BRIT). **Cleburne Co**.: *Peck 98061* (BRIT). **Crawford Co**.: *Peck 2010077* (BRIT). **Fulton Co**.: *Peck 98048* (BRIT). **Independence Co**.: *Peck 98066* (BRIT). **Hempstead Co**.: *Peck 2010054* (BRIT). **Hot Spring Co**.: *Peck 98074* (BRIT). **Howard Co**.: *Peck 2010058* (BRIT). **Johnson Co**.: *Peck 2010072* (BRIT). **Pike Co**.: *Peck 2010060* (BRIT). **Saline Co**.: *Walker sn* (BRIT). **Searcy Co**.: *Peck 98088* (BRIT). **Sevier Co**.: *Peck 2010056* (BRIT). **Van Buren Co**.: *Peck 98055* (BRIT). **Washington Co**.: *Haas 1519* (UCAC). **White Co**.: *Peck 98092* (BRIT).

ENGELMANN'S QUILLWORT – **Isoetes englemannii** A. Braun (Isoetaceae)—This species was discovered as new to Arkansas in Cleburne County by Don Culwell (Brown & Thomas 1992). It is now known from three counties in Arkansas.

Voucher specimen: **ARKANSAS. Cleburne Co**.: *Culwell 5925* (UCAC) . **Pike Co**.: *Peck 97346* (BRIT). **Van Buren Co**.: *Crank 94010* (HEND).

BLACKFOOTED QUILLWORT – **Isoetes melanopoda** Gay & Dur. (Isoetaceae)—With these 18 county vouchers, this species is now known from all 75 counties in Arkansas.

Voucher specimens: **ARKANSAS. Chicot Co**.: *Thomas 164609* (NLU). **Columbia Co**.: *Peck 97633* (BRIT). **Crawford Co**.: *Peck 2010079* (BRIT). **Desha Co**.: *Peck 98488* (BRIT). **Hempstead Co**.: *Peck 97649* (BRIT). **Howard Co**.: *Peck 97654* (BRIT). **Jackson Co**.: *Peck 2010021* (BRIT). **Lafayette Co**.: *Peck 97663* (BRIT). **Lawrence Co**.: *Peck 2010007* (BRIT). **Lincoln Co**.: *Peck 98483* (BRIT). **Little River Co**.: *Peck 97671* (BRIT). **Miller Co**.: *Peck 97679* (BRIT). **Nevada Co**.: *Peck 97683* (BRIT). **Prairie Co**.: *Peck 2010039* (BRIT). **Randolph Co**.: *Peck 2010009* (BRIT). **Scott Co**.: *Peck 2010066* (BRIT). **Sebastian Co**.: *Peck 2010075* (BRIT). **Sevier Co**.: *Sundell 14237* (UAM). **Woodruff Co**.: *Peck 2010025* (BRIT).

FOXTAIL BOG CLUBMOSS – **Lycopodiella alopecuroides** (L.) Cranfill (Lycopodiaceae)—This species was located for the first time in Arkansas by the author in 1985 on the Gulf Coastal Plain in Calhoun Co. (Peck & Peck 1988). It is now known from 15 counties in Arkansas, mainly on the Gulf Coastal Plain Region.

Voucher specimens: **ARKANSAS. Calhoun Co**.: *Peck 86164* **(BRIT). Cleveland Co**.: *Peck 96545* (BRIT). **Columbia Co**.: *Peck 98548* (BRIT). **Dallas Co**.: *Marsh 8498* (HEND). **Grant Co**.: *Peck 96561* (BRIT). **Hempstead Co**.: *Peck 98699* (BRIT). **Hot Spring Co**.: *Bray 117* (HEND). **Lafayette Co**.: *Peck 98664* (BRIT). **Little River Co**.: *Peck 98669* (BRIT). **Miller Co**.: *Peck 98676* (BRIT). **Nevada Co**.: *Marsh 8455* (HEND). **Ouachita Co**.: *Peck 98683* (BRIT). **Pulaski Co**.: *Murray sn* (BRIT). Saline Co.: Bray 122 HEND). Union Co.: Peck 94513 (BRIT).

APPRESSED BOG CLUBMOSS – **Lycopodiella appressum** (Chapman) Lloyd and Underwood (Lycopodiaceae)—This species was first collected in Arkansas by Flora A. Haas from Saline Co. in 1931. With these additional vouchers, the species is now known from 21 counties in Arkansas. The species is known from one locality in the Ouachita Mountain Region from an old field developed in a wet portion of a quarry, while the other 20 counties lie on the Gulf Coastal Plain Region of Arkansas.

Voucher specimens: **ARKANSAS. Cleveland Co.**: *Peck 96544* (BRIT). **Dallas Co.**: *Peck 96548* (BRIT). **Grant Co.**: *Peck 96560* (BRIT). **Howard Co.**: *Peck 98664* (BRIT). **Jefferson Co.**: *Walker 1107962* (UARK). **Little River Co.**: *Peck 98668* (BRIT). **Miller Co.**: *Logan 126* (HEND). **Pike Co.**: *Marsh 8504* (HEND). **Pulaski Co.**: *Witsell sn* (BRIT). **Sevier Co.**: *Peck 98682* (BRIT).

FEATHERSTEM BOG CLUBMOSS – **Lycopodiella prostrata** (Harper) Cranfill (Lycopodiaceae)—In Arkansas, this is the rarest of the three species of Bog Clubmosses, being discovered in Arkansas for the first time by the author in 1985 (Peck & Peck 1988). The species is now known from seven counties in the Arkansas Gulf Coastal Plain Region.

Voucher specimens: **ARKANSAS. Calhoun Co.**: *Peck 86319* (BRIT). **Clark Co.**: *Bray 205* (HEND). **Garland Co.**: *Marsh 8493* (HEND). **Hot Spring Co.**: *Marsh 8192* (HEND). **Nevada Co.**: *Marsh 8486* (HEND). **Pike Co.**: *Marsh 8840* (HEND). Saline Co.: Bray 120 (HEND).

BRUCE'S HYBRID CLUBMOSS – **Lycopodiella ×bruceii** Cranfill (Lycopodiaceae) [*L. appressa* × *prostrata*]—This hybrid was first discovered in Arkansas in Calhoun Co. by the author in 1985 (Peck & Peck 1988). The hybrid is now known from 8 counties on the Arkansas Gulf Coastal Plain Region.

Voucher specimens: **ARKANSAS. Calhoun Co.**: *Peck 86241* (BRIT). **Clark Co.**: *Bray 209* (HEND). **Garland Co.**: *Marsh 8494* (HEND). **Hot Spring Co.**: *Marsh 8484* (HEND). **Nevada Co.**: *Marsh 8487* (HEND). **Pike Co.**: *Marsh 8844* (HEND). **Saline Co.**: *Bray sn* (HEND). **Union Co.**: *Peck 94514* (BRIT).

COPELAND'S HYBRID CLUBMOSS – **Lycopodiella ×copelandii** (Eiger) Cranfill (Lycopodiaceae) [*L. alopecuroides* × *appressa*]—This hybrid was first discovered in Arkansas by Steve Orzell in 1985 from Calhoun Co. (Peck & Peck 1988). It is now known from 8 counties in the Gulf Coastal Plain Region of southern Arkansas.

Voucher specimens: **ARKANSAS. Calhoun Co.**: *Peck 86271* (BRIT). **Clark Co.**: *Bray 189* (HEND). **Dallas Co.**: *Marsh 8499* (HEND). **Nevada Co.**: *Marsh 8464* (HEND). **Pike Co.**: *Marsh 8843* (HEND). **Pulaski Co.**: *Peck 98001* (BRIT). **Saline Co.**: *Bray sn* (HEND). **Union Co.**: *Bray 199* (HEND).

GOLDEN WATERCLOVER – **Marsilea macropoda** Engelm. ex A. Braun in Kunze (Marsileaceae)—Once considered an endemic restricted to south-central Texas, this species was next located in an abandoned lot in New Orleans, Louisiana, in 1982 (Landry & Holder 1985). Jacono and Johnson (2006) also reported it from Alabama and Florida. It was brought into the water garden trade and made available across the southeastern USA (Hoshizaki & Moran 2001; Mickel 2003). In 2004 populations of this species were discovered in disturbed lowland hardwood swamps in southwestern Arkansas, adjacent to Texas. In 2010 a small population was located at the edge of Pleasant Lake, Little River Co., and at Oak Lake in nearby Miller Co. The populations were not near human habitation and their occurrence seemed natural. These outlier populations were potentially dispersed to these stations by waterfowl or less likely transported accidentally on aquatic watercraft.

Voucher specimens: **ARKANSAS. Little River Co.**: *Peck 2010106* (BRIT). **Miller Co.**: *Peck 2010105* (BRIT).

HAIRY WATERCLOVER – **Marsilea vestita** Hook. and Grev. (Marsileaceae)—First collected in Arkansas by Nuttall in 1819. George Englemann collected it along the Arkansas River in 1832 in the vicinity of Little Rock, where Witsell and Shepherd re-collected it in 1997 (Witsell & Shepherd 1999). Jacono and Johnson (2006) discussed the systematic of this species across the southeastern USA. With these records, the species is known from 18 Arkansas counties.

Voucher specimens: **ARKANSAS. Conway Co.**: *Peck 2010095* (BRIT). **Franklin Co.**: *Peck 2010096* (BRIT). **Jefferson Co.**: *Peck 98544, 2010104* (BRIT). **Johnson Co.**: *Peck 2010124* (BRIT). **Lincoln Co.**: *Sundell 15014* (UAM). **Logan Co.**: *Peck 2010097* (BRIT). **Perry Co.**: *Peck 2010103* (BRIT). **Pope Co.**: *Peck 2010098* (BRIT). **Pulaski Co.**: *Peck 2010102* (BRIT). **Sebastian Co.**: *Witsell 030829* (ANHC). **Yell Co.**: *Culwell sn* (UCAC).

BULBOUS ADDER'S-TONGUE FERN – **Ophioglossum crotalophoroides** Walt. (Ophioglossaceae)—First collected in Arkansas by Dwight Moore in 1945 in Nevada Co. Thomas (1978) reported it from 27 counties in Arkansas. It is now known from 47 counties, being collected mainly in bare spots in turf at rural cemeteries with minimal perpetual care.

Voucher specimens: **ARKANSAS. Arkansas Co.**: *Peck 98022* (BRIT). **Chicot Co.**: *Peck 99018* (BRIT). **Desha Co.**: *Peck 99012* (BRIT). **Lawrence Co.**: *Peck 96013* (BRIT). **Lonoke Co.**: *Peck 97005* (BRIT). **Monroe Co.**: *Peck 97031* (BRIT). **Scott Co.**: *Marsh 9706* (HEND). **Sharp Co.**: *Peck 96008* (BRIT). **Woodruff Co.**: *Peck 96019* (BRIT). **Yell Co.**: *Marsh 8621* (HEND).

LIMESTONE ADDER'S-TONGUE FERN – **Ophioglossum engelmannii** Prantl (Ophioglossaceae)—With these 4 vouchers, this species is now known from 33 counties in Arkansas.

Voucher specimens: **ARKANSAS. Jefferson Co.**: *Logan 109* (UCAC). **Lafayette Co.**: *Golden 101* (HEND). **Logan Co.**: *Peck 86117* (BRIT). **Saline Co.**: *Witsell 020162* (BRIT).

LEAST ADDER'S-TONGUE FERN – **Ophioglossum nudicaule** L. f. (Ophioglossaceae)—Discovered for the first time in Arkansas by R. Dale Thomas from Ashley Co. in 1972 (Thomas 1978). This species is now known from 22 counties in Arkansas mainly on the Gulf Coastal Plain Region.

Voucher specimens: **ARKANSAS. Arkansas Co.**: *Thomas 27299* (UARK). **Dallas Co.**: *Marsh 9617* (HEND). **Desha Co.**: *Marsh 9178* (HEND). **Grant Co.**: *Peck 99057* (BRIT). **Lafayette Co.**: *Golden 103* (HEND). **Miller Co.**: *Golden 107* (HEND). **Montgomery Co.**: *Cornell 170* (HEND). **Pike Co.**: *Golden 90* (HEND). **Sevier Co.**: *Golden 22* (HEND).

SOUTHERN ADDER'S-TONGUE FERN – **Ophioglossum pycnostichum** (Fernald) A. Löve & Löve (Ophioglossaceae)—With these 8 additional vouchers, this species is now known to occur in 37 counties in Arkansas.

Voucher specimens: **ARKANSAS. Boone Co.**: *Witsell 05333* (ANHC). **Cleveland Co.**: *Witsell 05045* (ANHC). **Crawford Co.**: *Dale sn* (UARK). **Lonoke Co.**: *Witsell 020112* (ANHC). **Pope Co.**: *Kirshberger 005* (UAM). **Saline Co.**: *Witsell 06048* (ANHC). **St. Francis Co.**: *Ambrose 17* (STAR). **Van Buren Co.**: *Witsell 05244* (BRIT).

CINNAMON FERN – **Osmunda cinnamomea** L. var. **cinnamomea** (Osmundaceae)—With these 13 additional vouchers, this species is now known from all 75 counties in Arkansas.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Hyatt 5640* (BRIT). **Boone Co.**: *Peck 98593* (BRIT). **Carroll Co.**: *Peck 98645* (BRIT). **Craighead Co.**: *Peck 2010016* (BRIT). **Crittenden Co.**: *Peck 2010034* (BRIT). **Fulton Co.**: *Peck 97585* (BRIT). **Johnson Co.**: *Johnson 5273* (APCR). **Lee Co.**: *Peck 97605* (BRIT). **Marion Co.**: *Peck 98080* (BRIT). **Mississippi Co.**: *Peck 2010016* (BRIT). **Philips Co.**: *Peck 98081* (BRIT). **Searcy Co.**: *Peck 99618* (BRIT). **Washington Co.**: *Peck 98612* (BRIT).

ROYAL FERN – **Osmunda regalis** L. var **spectabilis** (Willd.) Gray (Osmundaceae)—With these 13 additional vouchers, this species is now known from all 75 Arkansas counties.

Voucher specimens: **ARKANSAS. Boone Co.**: *Peck 98594* (BRIT). **Carroll Co.**: *Peck 98641* (BRIT). **Conway Co.**: *Culwell 4437* (UCAC). **Crittenden Co.**: *Peck 2010035* (BRIT). **Cross Co.**: *Peck 2010031* (BRIT). **Izard Co.**: *Peck 97581* (BRIT). **Lee Co.**: *Peck 97604* (BRIT). **Marion Co.**: *Peck 98079* (BRIT). **Mississippi Co.**: *Peck 2010017* (BRIT). **Phillips Co.**: *Peck 98691* (BRIT). **Randolph Co.**: *Peck 99544* (BRIT). **St. Francis Co.**: *Peck 2010036* (BRIT). **Searcy Co.**: *Peck 99617* (BRIT).

NODDING CLUBMOSS – **Palhinhaea cernuua** (L.) Vasconcellos & Franko (Lycopodiaceae)—This species was discovered for the first time in Arkansas by Jimbo Bray on 14 Oct 1995 in a barrow pit near Bluff City, Nevada Co. (Bray 1996). On 21 Oct 1995 it was inspected by Bray, Dan Marsh, Don Crank, and James Peck. At this time a small side stem was selected and carefully removed by Bray as a physical voucher. The station was revisited 14 Nov 1995 by Peck and W.H.Wagner, Jr., who noticed it was browning and becoming senescent. The plant persisted for three years at this location, but with failing vigor and thriftiness until it was no longer evident by 1997. No other plants of this species were seen at that time or in subsequent visits to the location.

Voucher specimen: **ARKANSAS. Nevada Co.**: *Bray 269* (HEND).

PURPLE-STEMMED CLIFF BRAKE – **Pellaea atropurpurea** (L.) Link (Pteridaceae)—With these two vouchers, the species is extended further to the northeast in Arkansas. This species is now known from 37 counties in the Ouachita and Ozark regions in Arkansas.

Voucher specimens: **ARKANSAS. Lawrence Co.**: *McNalley 665* (STAR). **Randolph Co.**: *Taylor 2092* (UARK).

SMOOTH CLIFF BRAKE – **Pellaea glabella** Mett. ex Kuhn subsp. **glabella** (Pteridaceae)—First reported from Arkansas by Buchholz and Palmer (1926). With this one addition the species is now known from 15 counties in Arkansas.

Voucher specimen: **ARKANSAS. Madison Co.**: *McWilliams 64* (UCAC).

SOUTHERN BEECH FERN – **Phegopteris hexagonopteris** (Michx.) Fee (Thelypteridaceae)—With these 10 vouchers, this species is now documented from all 75 counties in Arkansas.

Voucher specimens: **ARKANSAS**. **Chicot Co**.: *Peck 96278* (BRIT). **Clay Co.**: *Peck 97401* (BRIT). **Crittenden Co**.: *Peck 97374* (BRIT). **Desha Co.**: *Peck 96283* (BRIT). **Greene Co.**: *Peck 97391* (BRIT). **Jackson Co**.: *Peck 97382* (BRIT). **Mississippi Co.**: *Peck 97368* (BRIT). **Monroe Co.**: *Peck 97364* (BRIT). **Prairie Co**.: *Peck 99046* (BRIT). **Woodruff Co.**: *Peck 97371* (BRIT).

AMERICAN PILLWORT – **Pilularia americana** A. Br. (Marsileaceae)—First collected in North America by Nuttall (1835) from Fort Smith, Sebastian Co., Arkansas. With these five vouchers, the species is now known from 13 counties in west-central Arkansas, mainly from autumn collections following draw downs that exposed shoreline mudflats (Culwell 1994).

Voucher specimens: **ARKANSAS**. **Hot Spring Co**.: *J. Moore s.n.* (UAM). **Marion Co.**: *Witsell 050347* (ANHC). **Pope Co.**: *Witsell 07641* (ANHC). **Saline Co**.: *Witsell 050886* (ANHC). **Yell Co**.: *Peck 2003240* (BRIT).

COMMON POLYPODY -- **Polypodium virginianum** L. (Polypodiaceae)—With these two vouchers, this species is known from 23 counties in Arkansas in the Ouachita and Ozark regions.

Voucher specimens: **ARKANSAS**. **Polk Co**.: *Crank sn* (UAM). **White Co**.: *Edens sn* (LYON).

SLENDER BOG CLUBMOSS – **Pseudolycopodiella caroliniana** (L.) Holub (Lycopodiaceae)—This species was first discovered in Arkansas by Steve Orzell in 1985 (Peck & Peck 1988). Arkansas populations occur in spongy wet microhabitats associated with corrizzo soils (Bray & Marsh 1993). The Arkansas populations are some of the most southwestern in the USA range of the species. With these vouchers, the species is now known from 8 counties in Arkansas.

Voucher specimens: **ARKANSAS**. **Bradley Co**.: *Witsell 04906* (ANHC). **Calhoun Co.**: *Peck 86134* (BRIT). **Clark Co.**: *Bray 197* (HEND). **Hot Spring Co.**: *Marsh 8461* (HEND). **Nevada Co.**: *Marsh 8461* (HEND). **Pike Co**.: *Marsh 8839* (HEND). **Saline Co.**: *Moran sn* (BRIT). **Union Co.**: *Peck 94512* (BRIT).

WHISK FERN – **Psilotum nudum** (L.) P. Beauv. (Psilotaceae)—This species was first discovered in Arkansas as an escape from cultivation in a yard in Arkadelphia, Clark Co. (Bray, Whitehead, Marsh, McMasters, & Crank 1994). The first natural population was discovered in Lafayette Co. by the author in 1994 (Peck 1995). Subsequently, it was collected across extreme southern Arkansas (Peck & Taylor 1995). The species is now known from 13 counties in Arkansas.

Voucher specimens: **ARKANSAS**. **Ashley Co**.: *Peck 97623* (BRIT). **Bradley Co**.: *Peck 97432* (BRIT). **Calhoun Co**.: *Peck 99734* (BRIT). **Clark Co**.: *McMasters 95001* (HEND). **Columbia Co.**: *Peck 98188* (BRIT). **Drew Co.**: *Peck 97436* (BRIT). **Hempstead Co**.: *Stuckey sn* (BRIT). **Lafayette Co.**: *Peck 94003* (BRIT). **Little River Co.**: *Peck 2000374* (BRIT). **Miller Co**.: *Peck 2000344* (BRIT). **Nevada Co.**: *Peck 99243* (BRIT). **Ouachita Co**.: *Peck 98499* (BRIT). **Union Co.**: *Amason sn* (BRIT).

NORTHERN BRACKEN FERN – **Pteridium aquilinum** (L.) Kuhn var. **latiusculum** (Desv.) Heller (Dennstaedtiaceae)—With these 11 vouchers, this variety of Bracken Fern is documented from all 75 counties in Arkansas.

Voucher specimens: **ARKANSAS. Benton Co.**: *Greene sn* (UMO). **Chicot Co.**: *Peck 2010046* (BRIT). **Crittenden Co.**: *Peck 2010032* (BRIT). **Cross Co.**: *Peck 2010029* (BRIT). **Desha Co.**: *Peck 2010043* (BRIT). **Lee Co.**: *Peck 98644* (BRIT). **Mississippi Co.**: *Peck 2010014* (BRIT). **Monroe Co.**: *Peck 96212* (BRIT). **Phillips Co.**: *Peck 98665* (BRIT). **Poinsett Co.**: *Peck 2010019* (BRIT). **St. Francis Co.**: *Peck 98677* (BRIT).

SOUTHERN BRACKEN FERN – **Pteridium aquilinum** (L.) Kuhn var. **pseudocaudatum** (Clute) Heller (Dennstaedtiaceae)—With these 21 vouchers, this variety of Bracken Fern is documented from all 75 counties in Arkansas.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Peck 98712* (BRIT). **Boone Co.**: *Peck 98569* (BRIT). **Carroll Co.**: *Peck 98645* (BRIT). **Chicot Co.**: *Peck 2010047* (BRIT). **Clay Co.**: *Peck 98620* (BRIT). **Craighead Co.**: *Peck 2010012* (BRIT). **Crittenden Co.**: *Peck 2010033* (BRIT). **Desha Co.**: *Peck 2010044* (BRIT). **Jackson Co.**: *Peck 2010022* (BRIT). **Lawrence Co.**: *Peck 98603* (BRIT). **Madison Co.**: *Peck 99588* (BRIT). **Mississippi Co.**: *Peck 2010015* (BRIT). **Monroe Co.**: *Peck 2010038* (BRIT). **Newton Co.**: *Peck 99551* (BRIT). **Philips Co.**: *Peck 97417* (BRIT). **Poinsett Co.**: *Peck 2010020* (BRIT). **Randolph Co.**: *Peck 98627* (BRIT). **St. Francis Co.**: *Peck 97425* (BRIT). **Searcy Co.**: *Peck 98557* (BRIT). **Sharp Co.**: *Peck 98590* (BRIT). **Woodruff Co.**: *Peck 2010026* (BRIT).

MEADOW SPIKEMOSS – **Selaginella apoda** (L.) Spring ex Mart. (Selaginellaceae)—This species is widespread across Arkansas associated with wetland, riparian, and semi-aquatic microhabitats from ditches to streams mainly in the Ouachita and Ozark regions. With these 19 vouchers the species is known from 56 of the 75 counties in Arkansas.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Peck 2010088* (BRIT). **Benton Co.**: *Peck 2010085* (BRIT). **Boone Co.**: *Peck 2010087* (BRIT). **Carroll Co.**: *Peck 2010086* (BRIT). **Conway Co.**: *Peck 2010094* (BRIT). **Franklin Co.**: *Peck 2010091* (BRIT). **Independence Co.**: *Peck 97610* (BRIT). **Izard Co.**: *Peck 97589* (BRIT). **Johnson Co.**: *Peck 2010092* (BRIT). **Lawrence Co.**: *Peck 97613* (BRIT). **Marion Co.**: *Johnson 414* (HXC). **Newton Co.**: *Peck 2010089* (BRIT). **Randolph Co.**: *Peck 97589* (BRIT). **Searcy Co.**: *Peck 2010090* (BRIT). **Sebastian Co.**: *Peck 201093* (BRIT). **Sharp Co.**: *Peck 97613* (BRIT). **Stone Co.**: *Peck 97591* (BRIT). **Van Buren Co.**: *Peck 97614* (BRIT). **White Co.**: *Speer 207* (HARD).

ECLIPSED MEADOW SPIKEMOSS – **Selaginella eclipes** Buck (Selaginellaceae)—This species was named in 1977 by William Buck who separated it from *S. apoda*. The ranges of these species overlap in Arkansas. The microhabitats are similar as well, but the species different in leaf morphology and megaspore surface features. With these seven vouchers, this species is now known from 35 counties in Arkansas mainly in the Ouachita and Ozark regions.

Voucher specimens: **ARKANSAS. Conway Co.**: *Peck 2010071* (BRIT). **Johnson Co.**: *Peck 2010073* (BRIT). **Pope Co.**: *Golden 25* (HEND). **Pulaski Co.**: *Peck 2010001* (BRIT). **Scott Co.**: *Peck 20100068* (BRIT). **Sebastian Co.**: *Peck 2010083* (BRIT). **Yell Co.**: *Peck 2010069* (BRIT).

RIDDELL'S SPIKEMOSS – **Selaginella arenicola** Underwood subsp. **riddellii** (van Eselt.) R. Tryon (Selaginellaceae)—The North American range of this species is divided into two parts on either side of the Mississippi River with the eastern portion in Alabama, Florida, and Georgia and the western portion in Arkansas, Louisiana, Oklahoma, and Texas. When treated as separate species, the eastern

portion is named *S. arenicola* and the western portion is known as *Selaginella riddellii*. This spikemoss of dry, sandy soils was first discovered in Arkansas in 1967 by Gary Tucker (1971) and until recently occurred in 4 counties north of the Arkansas River and in 5 counties south of the Arkansas River. Field work has added one more county north of the Arkansas River in central Arkansas in sandy prairie on Arkansas River terraces in Pulaski County and two more counties in southwestern Arkansas along the Red River in Little River County and near Upper Red Lake in Hempstead Co. This species now is known from 12 Arkansas counties.

Voucher specimens: **ARKANSAS. Hempstead Co.**: *Peck 2009592* (BRIT). **Little River Co.**: *Peck 2009584* (BRIT). **Pulaski Co.**: *Peck 2009544* (BRIT).

ROCK SPIKEMOSS – **Selaginella rupestris** (L.) Spring (Selaginellaceae)—With these two vouchers this species is now known from 18 counties in Arkansas.

Voucher specimens: **ARKANSAS. Madison Co.**: *Wages sn* (UCAC). **Pulaski Co.**: *Peck 2009545* (BRIT).

NEW YORK FERN – **Thelypteris novaboracensis** (L.) Nieuwl. (Thelypteridaceae)—This species is common in its core or metropolis area in northeastern North America, but is considered rare in the Ozark and Ouachita regions of Arkansas where it is a western disjunct from the species's core range. With these additional vouchers this species is now known from 13 counties in Arkansas with six counties in the Ozark Region and seven counties in the Ouachita Region.

Voucher specimens: **ARKANSAS: Baxter Co.**: *Peck 99400* (BRIT). **Stone Co.**: *Peck 99391* (BRIT). **Van Buren Co.**: *Hendrix sn* (BRIT).

MARSH FERN – **Thelypteris palustris** Schott. (Thelypteridaceae)—This fern occurs across southern Arkansas in roadside seeps and in open marshes in northeastern Arkansas. Peck and Taylor (1995) reported this species in 13 counties, to which another 20 are added here.

Voucher specimens: **ARKANSAS. Arkansas Co.**: *Peck 2010040* (BRIT). **Clark Co.**: *Peck 2010064* (BRIT). **Cleveland Co.**: *Peck 2010050* (BRIT). **Columbia Co.**: *Peck 2010053* (BRIT). **Cross Co.**: *Witsell 05290.5* (ANHC). **Dallas Co.**: *Peck 2010051* (BRIT). **Hot Spring Co.**: *Peck 1986212* (BRIT). **Howard Co.**: *Peck 2010059* (BRIT). **Jackson Co.**: *Peck 2010024* (BRIT). **Jefferson Co.**: *Peck 2010043* (BRIT). *Lafayette* **Co.**: *Witsell 07587* (ANHC). **Lincoln Co.**: *Peck 2010042* (BRIT). **Miller Co.**: *Peck 2010055* (BRIT). **Nevada Co.**: *Peck 2010054* (BRIT). **Ouachita Co.**: *Peck 2010052* (BRIT). **Pike Co.**: *Peck 2010061* (BRIT). **Pulaski Co.**: *Peck 2010003* (BRIT). **Sevier Co.**: *Peck 2010057* (BRIT). **Union Co.**: *Sundell 7459* (BRIT). **Woodruff Co.**: *Peck 2010027* (BRIT).

WEFT FERN – **Trichomanes intracatum** Farrar (Hymenophyllaceae)—Four "tropical" fern genera form independent gametophyte colonies in the southeastern USA — *Grammitis*, *Hymenophyllum*, *Vittaria*, and *Trichomanes* (Farrar 1967). The colonies expand through vegetative growth of prothalli as extended filaments or ribbons and produce vegetative dispersal bodies called gemmae that may also play a role in sexual reproduction. Old colony prothalli are female and produce a sex hormone antheridogen that promotes maleness in young, gemma produced plants (Emigh & Farrar 1977). These "sporophyte-less" ferns are "old" endemic, disjunct species (Farrar 1990) that have persisted until the present time only as the gametophyte generation. They occur in deep canyons in stations called rock

houses, cliff-terrain sheltered habitats with moderated microclimates that provide "tropical" environments (Billings & Anderson 1966; Farrar 1998) with plant species that have persisted, an environmental inertia (Cole 1985), through major climatic changes in the surrounding uplands (Cole 1985; Farrar 1998). Farrar (1992) named the independent *Trichomanes* gametophyte *T. intricatum*. All populations were reported from states east of the Mississippi River, as far north as Vermont.

The genus *Trichomanes* is represented in Arkansas by *Trichomanes boshianum* Sturm ex Bosch. and *T. petersii* A. Gray. Independent *Trichomanes* gametophyte colonies occur without either sporophyte both in the Ozark and Ouachita regions in Arkansas. The gametophytes of the two species with sporophytes have gametophyte morphology similar to that of *T. intracatum* (Farrar 1992). Yet they are all quite distinct genetically as shown by enzyme electrophoresis, with *T. intracatum* sharing only 1 of 13 bands with *T. boschianum* and one of 18 bands with *T. petersii* (Farrar 1985). Although no samples from Arkansas were determined to be *T. intracatum*, it seems odd that the species could have persisted in the southeastern USA or have migrated (vacillated north then south in rhythm with glacial minima and maxima in the eastern USA during the Pleistocene, and during the present glacial minima have dispersed northward onto glaciated landscapes as far north as Massachusetts and Vermont (Farrar, Parks, & McAlpin 1963; McAlpin & Farrar 1978; Parks 1989) without having become established in the Ozarks, Ouachitas, or Tunica Hills west of the Mississippi River. The gametophyte specimen cited seems to be a bit different than those from populations with sporophytes, and is offered as a putative voucher.

Voucher specimen: ARKANSAS: **Stone Co.**: *Peck 2008380* (BRIT).

APPALACHIAN BRISTLE FERN – **Trichomanes boschianum** Sturm ex Bosch. (Hymenophyllaceae)—This spectacular filmy fern was first located in Arkansas by Delzie Demaree on 20 August 1961 at Cleburne Co. (Wagner 1962); a second station in Madison County was located by Maxine Clark on 4 February 1962 (Clark 1962). Since then two more stations were located in two additional counties. A fifth county is reported here. The Arkansas populations are disjunct from the metropolis or core range in the southern Appalachian Mountains, with the closet eastern population being in extreme northeast Mississippi (Menapace, Davison, & Webb 1998). This species is now known from five counties in Arkansas.

Voucher specimens: **ARKANSAS: Cleburne Co.**: *Peck 2009875* (BRIT). **Johnson Co.**: *Turnipseed 219* (APCR). **Madison Co.**: *Clark 1400* (MO). **Newton Co.**: *Bonar sn* (APCR). **Pope Co.**: *Peck 2009867* (BRIT).

PETER'S BRISTLE FERN – **Trichomanes petersii** A. Gray (Hymenophyllaceae)—This interesting filmy fern is often found only with the aid of a flashlight, as it favors growing in dark microhabitats beneath rock ledges and often most vigorously where extra-illumination is required (Moran 1998). The first Arkansas discovery of this fern was made in May of 1967 (Farrar & Redfearn (1968) in Pope County. Peck (1985) reported the first discovery of a natural population of this species on a man-made surface (mine drift entrance wall) in western Garland Co. Allen (1975) reported that in lieu of rock outcrops to the south in Louisiana the fern was growing on the wet dark bases of Magnolia and American beech trees. Bray (1996) reported that populations in southern Arkansas tended to be on bases of trees, then switch to novaculite rocks northward in the Ouachita Region, and to hard sandstones in the Ozark Region in northern Arkansas. The species had been located in 9 counties in Arkansas. While inspecting specimens at the herbarium of University of Arkansas at Fayetteville (UARK), it was noticed that the folder with Arkansas specimens of this species was empty. Thus, I am citing new

specimens to replace those 9 counties for which their vouchers were missing and 4 additional counties. This species is now known from 13 counties in Arkansas.

Voucher specimens: **ARKANSAS. Cleburne Co.**: *Peck 2009877* (BRIT). **Clarke Co.**: *Peck 2009885, 2009913* (BRIT). **Conway Co.**: *Peck 2009870* (BRIT). **Garland Co.**: *Peck 2009873* (BRIT). **Hot Spring Co.**: *Peck 2009889* (BRIT). **Johnson Co.**: *Peck 2009867* (BRIT). **Montgomery Co.**: *Peck 2009877* (BRIT). **Newton Co.**: *Peck 2009865* (BRIT). **Pike Co.**: *Peck 2009883, 2009903* (BRIT). **Pope Co.**: *Peck 2009868* (BRIT). **Saline Co.**: *Peck 2009918* (BRIT). **Stone Co.**: *Peck 2009870* (BRIT). **Van Buren Co.**: *Peck 2009137* (BRIT).

EASTERN BLUNT-LOBED CLIFF FERN – **Woodsia obtusa** (Spreng.) Torr. var. **obtusa** (Dryopteridaceae)—With these nine vouchers, this variety is now documented from all 75 counties in Arkansas.

Voucher specimens: **ARKANSAS. Chicot Co.**: *Peck 97426* (BRIT). **Craighead Co.**: *Peck 98601* (BRIT). **Crittenden Co.**: *Peck 99212* (BRIT). **Desha Co.**: *Peck 97442* (BRIT). **Jackson Co.**: *Peck 200211* (BRIT). **Mississippi Co.**: *Peck 99230* (BRIT). **Monroe Co.**: *Peck 200234* (BRIT). **Poinsett Co.**: *Peck 98624* (BRIT). **Woodruff Co.**: *Peck 200227* (BRIT).

WESTERN BLUNT-LOBED CLIFF FERN – **Woodsia obtusa** (Spreng.) Torr. var. **occidentalis** Windham (Dryopteridaceae)—With these 13 vouchers, the variety is now known from 43 counties in Arkansas mainly in the Ouachita and Ozark regions.

Voucher specimens: **ARKANSAS. Benton Co.**: *Peck 96544* (BRIT). **Clay Co.**: *Richards 5274* (STAR). **Greene Co.**: *Richards 5491* (STAR). **Howard Co.**: *Peck 96748* (BRIT). **Little River Co.**: *Peck 96714* (BRIT). **Madison Co.**: *Peck 98478* (BRIT). **Pulaski Co.**: *Witsell 01-0223* (ANHC). **Randolph Co.**: *Peck 97512* (BRIT). **Saline Co.**: *Witsell 06139* (ANHC). **Scott Co.**: *Peck 99312* (BRIT). **Sebastian Co.**: *Peck 2000206* (BRIT). **Sevier Co.**: *Peck 96731* (BRIT). **Sharp Co.**: *Richards 5995* (STAR).

APPALACHIAN MOUNTAIN WOODSIA – **Woodsia scopulina** D.C. Eaton subsp. **appalachiana** (T.M.C. Taylor) Windham (Dryopteridaceae)—This most isolated disjunct fern from the eastern USA was first discovered in Arkansas by E. J. Palmer (1924) at the top of Mt. Magazine in Logan Co. Since then it was discovered by Don Crank in 1996 from the eastern end of Ouachita Region in Perry Co. and in 2002 by Sara Nunn from Polk Co. in the western end of the Arkansas Ouachita Region. This species is now known from three counties in Arkansas.

Voucher specimens: **ARKANSAS. Logan Co.**: *Taylor 1045* (SIU). **Perry Co.**: *Peck 95006* (BRIT). **Polk Co.**: *Nunn 5321* (UARK).

NET-VEINED CHAIN FERN – **Woodwardia areolata** (L.) Moore (Blechnaceae)—With these 11 vouchers, this species is now known from 74 of the 75 counties of Arkansas, with only Benton Co. lacking a documented voucher.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Peck 96704* (BRIT). **Boone Co.**: *Peck 97340* (BRIT). **Carroll Co.**: *Peck 98214* (BRIT). **Clay Co.**: *Peck 97632* (BRIT). **Fulton Co.**: *Peck 96722* (BRIT). **Lawrence Co.**: *Peck 97681* (BRIT). **Marion Co.**: *Peck 99118* (BRIT). **Newton Co.**: *Witsell 99050* (ANHC). **Randolph Co.**: *Peck 98618* (BRIT). **Searcy Co.**: *Peck 97512* (BRIT). **Sharp Co.**: *Peck 96691* (BRIT). **Washington Co.**: *Peck 99111* (BRIT).

NATURALIZED SPECIES

SIMPLER EAST INDIAN HOLLY FERN – **Arachnioides simplicior** (Makino) Ohwi 'Variegata' (Dryopteridaceae)—Gordon (1981) reported *Arachnioides simplicior* new and naturalized to South Carolina and the USA. The species is tolerant of summer heat and drought in its native India, where it was brought into cultivation, making it an excellent hardy fern (Hoshizaki & Moran 2001; Mickel 2003) for propagation westward across the Gulf States to Texas. Escapes from cultivation were discovered in 2008 at Alsopp Park in Little Rock and at Garvan Woodland Gardens in Hot Springs. The former site seems truly adventive while the latter is an escape from formal planting. Larger fronds are variegated, but the anemic color pattern is reduced in juvenile fronds and after heat drying. The plants have persisted for 3 years. They are locally available at nurseries in Arkansas and available across the South. The slow growth of this non-native at these sites suggests that they are neither aggressive nor invasive. This is the first report of this species naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010125* (BRIT). **Pulaski Co.** *Peck 20100126* (BRIT).

JAPANESE PAINTED LADY FERN – **Athyrium niponicum** (Mett.) Hance 'Pictum' (Dryopteridaceae)—This non-native fern is readily available at plant nurseries and commonly cultivated across the eastern USA (Mickel 2003; Hoshizaki & Moran 2001). The fern is native to Japan where it was brought into cultivation. Although putatively sterile, plants were found some distance from formal plantings in central Arkansas. Escaped populations, one each in Hot Springs and Little Rock, were found in local wooded ravines in city greenbelts. The species is certainly not aggressive or invasive. This is the first report of this species naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010000* (BRIT). **Pulaski Co.**: *Peck 2010112* (BRIT).

FALCATE HOLLY FERN – **Cyrtomium falcatum** (L. f.) C. Presl (Dryopteridaceae)—This non-native fern is commonly available and widely planted across the southeastern USA (Hoshizaki & Moran 2001; Mickel 2003). All of the material cultivated in the USA was brought into cultivation in Japan (Oka 2008). In 2002 this species was first discovered as an escape from cultivation in Arkansas at Boyle Park, Little Rock, Pulaski Co., and subsequent to that it was found in greenbelt woods at Pine Bluff, Jefferson Co. Both are escapes from cultivation to urban greenbelt parks or woods with plantings or nurseries noted within 2 km of the plants (Peck 2003). A third station was recently discovered in Garvan Woodland Garden, Hot Springs, Garland Co. Escaped and adventive plants were noted with the ravine woods in areas that were not planted with ferns. These plants may have started from spores from the cultivated plants in the garden. At all stations in Arkansas the plants are slow growing, and thus this is not an aggressive or invasive species in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010237* (BRIT). **Jefferson Co.**: *Peck 2010237* (BRIT). **Pulaski Co.**: *Peck 2002744* (BRIT).

FORTUNE'S HOLLY FERN – **Cyrtomium fortunei** J. Smith var. **fortunei** (Dryopteridaceae)—This non-native cultivated fern is readily available in the southeastern USA hardy fern trade (Hoshizaki & Moran 2001; Mickel 2003). As all of our cultivated *Cyrtomium* in the USA are from Japan from the Kanto region, the key provided by Oka (2008) adds to our ability to identify cultivated and escaped materials. This fern was first noted in 1973 as growing adventively on old brick walls in Charleston,

South Carolina, and reported for the first time in North America by John M. McDougal (1976). Landry, Israel, Schwarzwalder, and Thomas (1979) reported escaped plants found in the Tunica Hills of Louisiana and collected by R. Dale Thomas in 1974 and in Lousiana and Mississippi in 1978 and 1979 by M. Isreal, G. Landry and R. Schwarzwalder. They thought that these stations might represent old escapes and local reproduction from plants from once numerous, old plantation gardens. In 1988, Wilson Baker showed me specimens for determination of *C. fortunei* from the batture lands of Desha County, Arkansas, in support of his field work conducted under contract to the Nature Conservancy of Arkansas. Such plants might also be escapes from cultivation around old plantations. The specimens were to be deposited at Tall Timbers Research Laboratory, outside Tallahassee, Florida (Peck 2003). After 20 years of asking to annotate the voucher specimens, in 2010 the collector has confirmed that the vouchers are not at that herbarium and their location is now unknown. Therefore, while the species may actually occur in Arkansas, new vouchers are required, and until the population is refound, must be considered deleted or removed from the documented flora of Arkansas.

AUTUMN FERN – **Dryopteris erythrosora** (D.C. Eaton) O. Kunze (Dryopteridaceae)—This non-native fern was brought into cultivation in Asia where it is native to China and Japan. It is commonly available and widely planted in the southeastern USA (Hoshizaki & Moran 2001; Mickel 2003). It was reported earlier as having escaped far from local cultivation in Arkansas (Simpson, Crank, Witsell, & Peck 2008) into timberland in Hot Spring Co. Since then it has been found as adventive or escaped plants in 6 more Arkansas counties. While readily spreading from spores, this species is not so aggressive that it warrants being called invasive but bears watching for additional adventive stations across southern Arkansas in timber lands. This species is naturalized in 7 counties in Arkansas.

Voucher specimens: **ARKANSAS. Columbia Co.**: *Peck 2011007* (BRIT). **Garland Co.**: *Peck 2008035* (BRIT). **Hot Spring Co.**: *Peck 20072041* (BRIT). **Little River Co.**: *Peck 2009101* (BRIT). **Pulaski Co.**: *Peck 2008011* (BRIT). **Ouachita Co.**: *Peck 2009073* (BRIT). **Union Co.**: *Peck 2010695* (BRIT).

SMOOTH BRAMBLE FERN – **Hypolepis tenuifolia** (G. Forster) Bernh. (Dennstaedtiaceae)—Although not well known (Brownsey 1983) in the southeastern fern garden trade, this non-native fern from Asia and the South Pacific can play an excellent role in larger spaces where a robust fern can roam. It is robust enough in form and expansion to be used sparingly. It is not as large, aggressive, or invasive as the related *Hypolepis reptans*, which has spinulose projections along the stipe and rachis (Mickel 2003; Hoshizaki & Moran 2001). In Arkansas *Macrothelypteris torresiana* has filled this role in mid-sized spaces, and is escaping regularly. *Hypolepis tenuifolia* was formally planted in four counties in garden settings and has escaped by spores to additional areas nearby. Nowhere is it too aggressive or invasive that it cannot be managed with mechanical or chemical methods. As this species becomes recognized for large gardens and used more regularly, it will escape readily across the southern one-half of the state and perhaps to the north of Little Rock. This is the first report of this species naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Faulkner Co.**: *Peck 2010275* (BRIT). **Garland Co.**: *Peck 2010276* (BRIT). **Union Co.**: *Peck 19950102* (BRIT).

JAPANESE CLIMBING FERN – **Lygodium japonicum** (Thunb.) Sw. (Lygodiaceae)—This non-native fern was collected in Arkansas for the first time by Charles Meyer in 1981 from Ashley County (Taylor 1984). Since then other naturalized plants were discovered in the wild across the southern one-half of the state (Peck, Peacock, & Shepherd 1985; Sundell 1986). Urban escapes are known from 5 counties.

An earlier collection by R. Armstrong in Ft. Smith, Sebastian Co., in 1955 was an obvious escape from local cultivation. Other spontaneous escapes were found in 1983 by William Shepherd in Pulaski Co. with no known source plant in the neighborhood. At Calion in Union Co., Carl Amason tended numerous plants that grew upwards of 40 foot long vines (a single leaf) and were quite fertile, spreading many adventive juveniles throughout his property. Urban escapes are also known from Hot Springs (Garland Co.) and Malvern (Hot Spring County). Although an invasive species in Florida, Arkansas winters are usually sufficiently cold to thin the adult leaves or vines to one overwintering green leaf midrib from which regrowth occurs in the spring. This vine fern has provided a fire torch from ground fires into crown fires in timber lands in Florida, but it has not been documented in Arkansas. Peck and Taylor (1995) reported this fern from 14 Arkansas counties; now known from 25 counties in Arkansas.

Voucher specimens: **ARKANSAS. Clark Co.**: *Peck 2002033* (BRIT). **Cleveland Co.**: *Peck 2003133* (BRIT). **Dallas Co.**: *Peck 2002338*. **Garland Co.**: *Crank 93005* (HEND). **Grant Co.**: *Peck 2002144* (BRIT). **Hot Spring Co.**: *Gillaspy 80* (HEND). **Jefferson Co.**: *Peck 2002353* (BRIT). **Lincoln Co.**: *Peck 2010238* (BRIT). **Pike Co.**: *Peck 2003210* (BRIT). **Pulaski Co.**: *Peck 2003100* (BRIT). **Sebastian Co.**: *Armstrong sn* (UARK).

TORRES'S FERN – **Macrothelypteris torresiana** (Gaud.) Ching (Thelypteridaceae)—This is a widely available species in the hardy fern trade that is readily planted across the southeastern USA (Leonard 1972). Native to the Mariana Islands in the Pacific Ocean, this tropical species is now widespread around the world and common in Central America. It was reported for the first time in Arkansas beyond cultivation by Taylor and Johnson (1979). This non-native fern regularly escapes and is adventive as well and is now known across the southern half of Arkansas. It regularly shows up in disturbed dry sandy soils in timber farms or along county or timber access roads (Peck, Peacock, & Shepherd 1985). When given plenty of space it provides large arrays of fronds from rapidly growing rhizome colonies. It is faster growing and spreading than bracken but can be controlled readily by mechanical or chemical methods (Mickel 2003; Hoshizaki & Moran 2001). When this species becomes more established and recognized for its large garden potential, it is expected to escape and become established in counties to the north of Little Rock. Peck and Taylor (1995) reported this fern from 12 counties, to which another 14 are added.

Voucher specimens: **ARKANSAS. Arkansas Co.**: *Peck 1998327* (BRIT). **Calhoun Co.**: *Thomas 141528* (UAM). **Clark Co.**: *Peck 2010232* (BRIT). **Crittenden Co.**: *Roger 106* (BRIT). **Cross Co.**: *Witsell 051150* (ANHC). **Dallas Co.**: *Peck 1997567* (BRIT). **Desha Co.**: *van Horn sn* (UAM). **Garland Co.**: *Crank 95007* (HEND). **Grant Co.**: *Peck 2010230* (BRIT). **Hempstead Co.**: *Peck 1998448* (BRIT). **Hot Spring Co.**: *Crank 95006* (HEND). **Jefferson Co.**: *Peck 20100231* (BRIT). **Lee Co.**: *Peck 2010233* (BRIT). **Marion Co.**: *Witsell 07409* (BRIT). **Monroe Co.**: *Peck 1998414* (BRIT). **Nevada Co.**: *Peck 1999357* (BRIT). **Ouachita Co.**: *Peck 2000044* (BRIT). **Pulaski Co.**: *Peck 20100235* (BRIT). **Saline Co.**: *Carneal 119* (BRIT). **St. Francis Co.**: *Peck 2010234* (BRIT).

VARIEGATED WATERCLOVER – **Marsilea mutica** Mett. (Marsileaceae)—This non-native species is readily available and widely planted across the southeastern USA (Hoshizaki & Moran 2001; Mickel 2003). The species is native to Australia and new Caledonia. The variegated or white central portion of the "four-leaf clover-like" frond makes this an easy species to distinguish from other *Marsilea*. As an escape, it was reported first from Virginia (Knepper, Johnson, & Musselman 2002). By 2008, it was reported from Maryland (Redman 2008) and had been discovered in Alabama, Florida, Georgia,

Mississippi, South Carolina, and Oklahoma as well (Jacono & Johnson 2006). The two stations in Arkansas were located near Pine Bluff in 2004 and Little Rock in 2006. Both stations were disturbed lowland areas with dumping of compost and anthropogenic trash evident. The populations might have escaped from human cultivation or been the result of waterfowl dispersal, or both. The Arkansas populations were expected based on Oklahoma populations to the west and on numerous states eastward to Florida and then north to Maryland. This is the first report of this species naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Jefferson Co.**: *Peck 2010101* (BRIT). **Pulaski Co.**: *Peck 2010100* (BRIT).

European Waterclover – **Marsilea quadrifolia** L. (Marsileaceae)—This non-native species was introduced from Europe into Connecticut from where it escaped by 1860 (Johnson 1986) and has spread as far west as two counties in Iowa (Peck 1976) and three counties in Missouri (Johnson 1985). Jacono and Johnson (2006), Johnson (1993), and Henry (1983) all make a point that "*M. quadrifolia* has not extended south of Maryland, Kentucky or Missouri," appearing "restricted to the more humid range of the cold temperate North." The southwesternmost populations are now known from along the Arkansas River or impoundments or wetlands adjacent to that river. It was first discovered along the Little Maumelle River adjacent to the Arkansas River at Little Rock, Pulaski Co., in 2007 (Simpson, Crank, Witsell, & Peck 2008; Serviss & Peck 2008). It was discovered not far from the Arkansas River at Spring Lake in Yell Co. by Sara Nunn in 2009 and along the Arkansas River at Pine Bluff in 2010. It is very likely that waterfowl brought it to Arkansas from states to the north (Illinois, Iowa, or Missouri). Once here, waterfowl certainly could be dispersing it further up and down riparian habitats of the Arkansas River.

Voucher specimens: **ARKANSAS. Jefferson Co.**: *Peck 2010109* (BRIT). **Pulaski Co.**: *Peck 20071514* (BRIT). **Yell Co.**: *Peck 2010108* (BRIT).

Ostrich Fern – **Matteuccia struthiopteris** (L.) Todaro var. **pensylvanica** (Willd.) C.V. Morton (Dryopteridaceae)—This species is the edible fern of northeastern North America. It was a popular plant to grow around mid-western farm houses and city homes, with wild populations reduced to supply the demand. It still remains a popular hardy fern for cultivation in the Midwest (Hoshizaki & Moran 2001; Mickel 2003). By searching for old homesteads, old field plots, and out-buildings and garden-patch farms across the upland counties of Arkansas, an effort was made to find evidence of fern cultivation for aesthetics or use as spring tonic was still evident. The most vigorous plants were on wooded north-facing slopes with springs or seeps that protected the plants from the heat and drought of upland conditions. The more exposed or less protected plants were marginal to declining or remnant plants that were less thrifty. All of these plants were likely brought by settlers to these stations from the east or north and replanted, and in some cases persisted as mute testimony to failed subsistence farms. No plants were found that could be called native to Arkansas. While the species is native to the USA, it presence in Arkansas must be judged as planted, persisting, or escaped from cultivation and naturalized.

Voucher specimens: **ARKANSAS. Baxter Co.**: *Peck 2009591* (BRIT). **Boone Co.**: *Peck 2009604* (BRIT). **Carroll Co.**: *Peck 2009598* (BRIT). **Cleburne Co.**: *Peck 2009610* (BRIT). **Fulton Co.**: *Peck 20100123* (BRIT). **Garland Co.**: *Peck 2009606* (BRIT). **Hot Spring Co.**: *Peck 2009608* (BRIT). *Izard Co.*: *Peck 2009592* (BRIT). **Lawrence Co.**: *Peck 2009596* (BRIT). **Logan Co.**: *Peck 2009605* (BRIT). **Madison Co.**: *Peck 2009573* (BRIT). **Marion Co.**: *Peck 2009603*

(BRIT). **Montgomery Co.**: *Peck 2009607* (BRIT). **Newton Co.**: *Peck 2009572* (BRIT). **Pope Co.**: *Peck 2009601* (BRIT). **Randolph Co.**: *Peck 2009595* (BRIT). **Searcy Co.**: *Peck 2009609* (BRIT). **Sharp Co.**: *Peck 2009594* (BRIT). **Stone Co.**: *Peck 2009593* (BRIT). **Van Buren Co.**: *Peck 2009597* (BRIT). **White Co.**: *Peck 2009690* (BRIT). **Yell Co.**: *Peck 2009599* (BRIT).

YANKEE FERN – **Nephrolepis exaltata** (L.) Schott. (Dryopteridaceae)—This species is native to southern Florida and has been reported as naturalized in Louisiana and Texas. This garden trade species in Arkansas (Peck 2002) was first reported as a naturalized plant found in a wet, lowland woods east of Pine Bluff, Jefferson Co., along the Arkansas River. The plant had 20 fronds but was not very thrifty, vigorous, or fertile. While known from the wild in only one Arkansas county, it is grown on porches and patios in all 75 counties in Arkansas. The origin of the plant could have been the result of spore long distance dispersal or from spring flooding and movement of plants from other locations. It is surprising that no other naturalized plants or populations are known from Arkansas. The species in Arkansas appears to have a low invasive potential but occurs aggressively in swamps in southern Florida, perched on stumps and downed trees, from which many cultivars have been selected for hanging baskets plants.

Voucher specimens: **ARKANSAS. Jefferson Co.**: *Peck 2001101, 2001388* (BRIT).

STALKED ADDER'S-TONGUE FERN – **Ophioglossum petiolatum** Hooker (Ophioglossaceae)—R. Dale Thomas first collected this fern in Arkansas in 1972 at a Union Co. cemetery and subsequently in Dallas Co. in 1972, White Co. in 1973 and Jefferson Co. in 1975 (Thomas 1978). The species was collected as far north as southeastern Missouri (Thomas, Marx, use Lawson 1974). Bray, Whitehead, Marsh, McMasters, and Crank (1994) added Clark Co. The species is commonly located in old, rural cemeteries, particularly beneath the eaves of buildings, bare or clay patches, or in lawn ruts where water might pool and reside a bit longer. Another easy way to locate plants is to search the soil at the base of crepe myrtles or Japanese maples in plantings or pots or at nurseries. Probably spread across the southeastern USA in pots or plantings from nurseries to cemeteries. The species is native to Asia and India, with first USA records from 1900 to 1930, again suggesting a late introduction. Its weedy habits account for its escapes and naturalization in nurseries and cemeteries. With these 27 county vouchers, the species is now known from 54 counties in Arkansas.

Voucher specimens: **ARKANSAS. Ashley Co.**: *Peck 96007* (BRIT). **Chicot Co.**: *Peck 96009* (BRIT). **Clay Co.**: *Peck 97058* (BRIT). **Conway Co.**: *Peck 99088* (BRIT). **Craighead Co.**: *Peck 97049* (BRIT). **Crittenden Co.**: *Peck 96038* (BRIT). **Cross Co.**: *Peck 96033* (BRIT). **Desha Co.**: *Peck 96015* (BRIT). **Drew Co.**: *Peck 96011* (BRIT). **Faulkner Co.**: *Peck 98085* (BRIT). **Greene Co.**: *Peck 97055* (BRIT). **Independence Co.**: *Peck 98073* (BRIT). **Jackson Co.**: *Peck 98075* (BRIT). **Lawrence Co.**: *Peck 98078* (BRIT). **Lee Co.**: *Peck 96023* (BRIT). **Mississippi Co.**: *Peck 97043* (BRIT). **Montgomery Co.**: *Peck 99097* (BRIT). **Perry Co.**: *Peck 99092* (BRIT). **Phillips Co.**: *Peck 96019* (BRIT). **Poinsett Co.**: *Peck 97046* (BRIT). **Polk Co.**: *Peck 99095* (BRIT). **Pope Co.**: *Peck 99110* (BRIT). **Pulaski Co.**: *Peck 96005* (BRIT). **Randolph Co.**: *Peck 98065* (BRIT). **St. Francis Co.**: *Peck 96027* (BRIT). **Woodruff Co.**: *Peck 98082* (BRIT). **Yell Co.**: *Peck 99105* (BRIT).

WINGED BEECH FERN – **Phegopteris decursive-pinnata** (H.C. van Hall) Fee (Thelypteridaceae)—This non-native species is an exceptionally attractive hardy fern (Hoshizaki & Moran 2001; Mickel 2003). It occurred spontaneously at Garvan Woodland Gardens, Hot Springs, in Garland Co. The species was not planted but has shown up in a rock-lined water pool on sandstone rocks. It may have been brought

to the garden in potting soils of other cultivated and planted ferns. Thus it may have been brought to the garden unintentionally. The rocks were obtained locally and thus were not the source. The species is not available locally but is grown at the production nursery in Texas where many of the hardy ferns were obtained. It may spread further around this hardy fern display garden. This is the first report of this species naturalizing in Arkansas.

Voucher specimen: **ARKANSAS. Garland Co.**: *Peck 2010236* (BRIT).

KOREAN ROCKFERN -- **Polystichum tsus-simense** (Hooker) J. Smith var. **mayebarae** (Tagawa) Sa. Kurata (Dryopteridaceae)—This non-native species is an exceptionally attractive fern for rock gardens (Hoshizaki & Moran 2001; Mickel 2003). It occurred spontaneously twice in a terrestrial rock garden in Garvan Woodland Gardens, Hot Springs, Garland Co. The species is available locally. It grows in cultivation at the production nursery in Texas from where many hardy fern plants were obtained to stock this garden. The sandstone rocks were obtained locally. It is presumed that it was unintentionally brought to the garden in planting soil or on other fern specimens. While escaping from cultivation, the slowness of the growth and the degree of moderation required for summer survival in Arkansas makes the likelihood of this species becoming of invasive concern seem quite remote. This is the first report of this species naturalizing in Arkansas.

Voucher specimen: **ARKANSAS. Garland Co.**: *Peck 2010239* (BRIT).

SPIDER BRAKE -- **Pteris multifida** Lam. (Pteridaceae)—This cultivated fern was reported from Arkansas by Chandler (1941) as naturalized and growing on the calcareous tuffa outcrops behind the historic bath house row at Hot Springs National Park, Garland Co. The second report of this species naturalizing as an escape from cultivation in Arkansas was from the Carl Amason property outside Calion, Union Co. (Sundell, Thomas, Amason, Stuckey, & Logan 1999). A third instance was noted by Eric Sundell in Alsopp Park within the city limits of Little Rock, Pulaski Co. This apogamous species, native to eastern Asia, is readily capable of producing new sporophytes from single spores. The species is now known as naturalized in three Arkansas counties.

Voucher specimens: **ARKANSAS. Garland Co.**: *Taylor 2708* (SIU). **Pulaski Co.**: *Sundell 18346* (ANHC). **Union Co.**: *Witsell 050128* (ANHC).

LEAST WATER SPANGLES – **Salvinia minima** Baker (Salviniaceae)—This small water garden fern is native to Central America, Mexico, and the West Indies. It is arguable whether this species is native to the USA. It has since become naturalized and spread from Florida west to Texas and north to Georgia. Greenhouse plants were reported from Minnesota but were not native, naturalized, or persistent. The species was first discovered in Arkansas in Lonoke County in 1998 by the author (Peck 1999, 2001) and it is now known from 13 counties. Strong cold winters, intense droughts, and years with twice normal rainfall have reduced the size of local infestations. This non-native species is not nearly hardy or weedy enough to be regarded as invasive.

Voucher specimens: **ARKANSAS. Arkansas Co.**: *Peck 99003, 99004* (BRIT). **Chicot Co.**: *Peck 20000214* (BRIT). **Desha Co.**: *Peck 99574* (BRIT). **Garland Co.**: P*eck 2004260* (BRIT). **Hot Spring Co.**: *Peck 2004245* (BRIT). **Jefferson Co.**: *Peck 99562* (BRIT). **Lee Co.**: *Peck 99583* (BRIT). **Lincoln Co.**: *Peck 99570* (BRIT). **Lonoke Co.**: *Peck 98002, 99001* (BRIT). **Monroe Co.**: *Peck 99588* (BRIT). **Phillips Co.**: *Peck 99579* (BRIT). **Prairie Co.**: *Peck 99002* (BRIT). **Pulaski Co.**: *Peck 99650* (BRIT).

GIANT WATER SPANGLES – **Salvinia molesta** D.S. Mitchell (Salviniaceae)—This non-native species was introduced probably from Brazil into the water garden trade of the USA in Florida and has since escaped and spread northward up the Atlantic coastal plain to South Carolina and westward along the Gulf Coastal states to Texas (Jacono 1999a, 1999b). Identification of non-native *Salvinia* have remained problematic as they are sometimes difficult to identify, have a long history in the commercial water garden trade, appear to readily escape from cultivation, increasing their ranges into areas where they were not known, and differ in degree of invasiveness (Riefner & Smith 2009). Until recently, all *Salvinia* in Arkansas were assigned to *S. minima* Baker (Peck 1999, 2001). Since then, two stations with *Salvinia molesta* were discovered, one in extreme southwest Arkansas and a second in central Arkansas. In 2008 a small population was located in McKinney Bayou of the Red River in the Sulphur Bottoms, Miller Co. The area is a flood plain with cut-off meander scars forming small ponds and lakes in low land woods or swamps. In 2009, a patch of plants was found floating down the Little Maumelle River at Little Rock, in Pulaski Co. Upstream the river is dominated with cypress swamps and contains a high diversity of emergent vegetation. The plants in Miller Co. were probably spread by waterfowl; those in Pulaski Co. may have been transported there by fishing boats or waterfowl. This extends the range some 300 km north from Louisiana and Texas. This is the first report of this species naturalizing in Arkansas. Strong cold winters, intense droughts, and flood years with twice normal rainfall have reduced the size of local infestations but may have just flushed or transferred the problem downstream. This non-native species has been regarded as a notorious, highly invasive weed. Its status and fate in Arkansas remains to be seen.

Voucher specimens: **ARKANSAS. Miller Co.**: *Peck 20080851* (BRIT). **Pulaski Co.**: *Peck 20090923* (BRIT).

BRAUN'S SPIKEMOSS – **Selaginella braunii** Baker (Selaginellaceae)—This species was brought into cultivation in China and is commonly grown across the southeastern USA (Hoshizaki & Moran 2001; Mickel 2003) where it has naturalized. Known in the Arkansas trade as Arborvitae Fern, it grows into a reasonably thick ground cover. It has escaped from cultivation within Garvan Woodland Gardens in Garland Co. and has escaped from an unknown source and become naturalized in Alsopp Park, Little Rock, in Pulaski Co. The species is somewhat drought sensitive and winter sensitive in Arkansas, and it certainly is not aggressive enough to have much invasive potential. This is the first report of this species naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010113, 2010272* (BRIT). **Pulaski Co.**: *Peck 2010118* (BRIT).

KRAUSS'S SPIKEMOSS – **Selaginella kraussiana** (Kunze) A. Braun (Selaginellaceae)—This species is native to Africa and is one of the most common spikemosses cultivated in greenhouses (glasshouses). It is hardy and cultivated across the southeastern USA and is known to escape and naturalize there (Hoshizaki & Moran 2001; Mickel 2003). Besides the typical species, a handful of cultivars have been brought into cultivation and are also widely grown. It has escaped from cultivation within Garvan Woodland Gardens in Garland Co. and has escaped from an unknown source and become naturalized in Alsopp Park, Little Rock, in Pulaski Co. The species is somewhat drought sensitive and winter sensitive in Arkansas, and it certainly is not aggressive enough to have much invasive potential. This is the first report of this species naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010115, 2010242* (BRIT). **Pulaski Co.**: *Peck 2010120, 2010243* (BRIT).

GOLDEN SPIKEMOSS – **Selaginella kraussiana** (Kunze) A. Braun 'Aurea' (Selaginellaceae)—This cultivar is entirely golden in color, contrasting with the darker green of the next cultivar or only the tips being golden in the latter cultivar. It has escaped from cultivation within Garvan Woodland Gardens in Garland Co., and has escaped from an unknown source and become naturalized in Alsopp Park, Little Rock, in Pulaski Co. The species is somewhat drought sensitive and winter sensitive in Arkansas, and it certainly is not aggressive enough to have much invasive potential. This is the first report of this cultivar naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010241* (BRIT). **Pulaski Co.**: *Peck 2010240* (BRIT).

PINCUSHION SPIKEMOSS – **Selaginella kraussiana** (Kunze) A. Braun 'Brownii' (Selaginellaceae)—This cultivar is more compact, more bushy, darker green, and more erect than the species or its other cultivars. It is known in the hardy fern trade as Pincushion Fern. It has escaped from cultivation within Garvan Woodland Gardens in Garland Co. and has escaped from an unknown source and become naturalized in Alsopp Park, Little Rock, in Pulaski Co. This distinct cultivar has spread from spores into the lawn, across the lawn by lawn mower, and down slope from water flow. The species is somewhat drought sensitive and winter sensitive in Arkansas, and it certainly is not aggressive enough to have much invasive potential. This is the first report of this cultivar naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010117* (BRIT). **Pulaski Co.**: *Peck 2010121* (BRIT).

GOLDTIPS SPIKEMOSS – **Selaginella kraussiana** (Kunze) A. Braun 'Goldtips' (Selaginellaceae)—This cultivar is readily identified by its main axis dark foliage contrasting with the tips of the stems with golden coloration. It has escaped from cultivation within Garvan Woodland Gardens in Garland Co. and has escaped from an unknown source and become naturalized in Alsopp Park, Little Rock, in Pulaski Co. The species is somewhat drought sensitive and winter sensitive in Arkansas, and it certainly is not aggressive enough to have much invasive potential. This is the first report of this cultivar naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010116* (BRIT). **Pulaski Co.**: *Peck 2010122* (BRIT).

PEACOCK SPIKEMOSS – **Selaginella uncinata** (Desv. ex Poir.) Spring (Selaginellaceae)—This spikemoss was brought into cultivation in China and is commonly planted in the southeastern USA where it is known to escape from cultivation (Hoshizaki & Moran 2001; Mickel 2003). When grown in low light habitats, plants of this species present blue-green iridescent foliage, leading to its name in the Arkansas trade as the Peacock Fern. It has escaped from cultivation within Garvan Woodland Gardens in Garland Co. and has escaped from an unknown source and become naturalized in Alsopp Park, Little Rock, in Pulaski Co. The species is somewhat drought sensitive and winter sensitive in Arkansas, and it certainly not aggressive enough to have much invasive potential. This is the first report of this species naturalizing in Arkansas.

Voucher specimens: **ARKANSAS. Garland Co.**: *Peck 2010114, 2010271* (BRIT). **Pulaski Co.**: *Peck 2010119* (BRIT).

KUNTH'S FERN – **Thelypteris kunthii** (Desv.) Morton (Thelypteridaceae)—This fern is common in northern South America, Central America, and the West Indies. It is common in the garden trade across the southeastern USA (Hoshizaki & Moran 2001; Mickel 2003). It is commonly planted as a landscape plant and frequently escapes. It was first discovered in Arkansas by David Johnson in 1975 in rural timber lands of Ashley Co. It was reported as naturalized by Taylor and Johnson (1979). Peck and Taylor (1995) reported it from 13 counties across southern Arkansas and another 13 counties are reported here.

Voucher specimens: **ARKANSAS. Bradley Co.**: *Peck 1997457* (BRIT). **Calhoun Co.**: *Peck 1998255* (BRIT). **Clark Co.**: *Peck 1998297* (BRIT). **Dallas Co.**: *Peck 1999369* (BRIT). **Garland Co.**: *Crank 92043* (Henderson). **Grant Co.**: *Peck 1999410* (BRIT). **Hot Spring Co.**: *Peck 1999488* (BRIT). **Izard Co.**: *Johnson 422* (HXC). **Jefferson Co.**: *Warriner 19900149-50* (BRIT). **Johnson Co.**: *Witsell 08311* (ANHC). **Pulaski Co.**: *Peck 1997267* (BRIT). **Saline Co.**: *Peck 1999626* (BRIT). **Stone Co.**: *Peck 1999391* (BRIT). **White Co.**: *Scudder sn* (HARD).

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IS *CALYPTOCARPUS VIALIS* (ASTERACEAE) NATIVE OR INTRODUCED IN TEXAS?

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ABSTRACT

Yes and no. *Calyptocarpus vialis* is native to eastern Mexico and to south and south-central Texas, apparently recently adventive (non-native, introduced) elsewhere in the state as well as in the USA and outside of North America. It characteristically grows in open and ruderal habitats over all of its range. One map shows the Texas county distribution, with symbols indicating the earliest date of collection in each county and suggesting the general pattern of native distribution within the state; another map shows the distribution of the species in Mexico.
KEY WORDS: *Calyptocarpus vialis*, Asteraceae, native, non-native, Texas, Mexico

Calyptocarpus vialis Less., the Straggler Daisy, is considered by the Lady Bird Johnson Wildflower Center (2011) to be **native** in Texas: "Depending on your point of view, Straggler Daisy is a pest or a welcome, shade-tolerant groundcover that tolerates moderate foot traffic. If you have a shady lawn anywhere within its range, you probably already have it. It gained in popularity during the growth in interest in native plants and is now occasionally available for sale at native plant nurseries (though it is so easy to propagate that you can easily grow it on your own)." It was considered by Strother (2006) to be **native** to Texas, Louisiana, Mississippi, Alabama, and Florida. In contrast, the Straggler Daisy is characterized without caveat in the PLANTS Database (USDA, NRCS 2011) as **introduced** in the "lower 48" states and in Hawaii. It apparently is not regarded anywhere in the USA as "invasive" or "noxious."

Characteristic habitats for the Straggler Daisy include roadsides, lawns, fields, vacant lots, and clearings and disturbances in woodlands. It grows abundantly in sandy as well as clay soils. The prevalence of ruderal habitats surely underlies the common perception of the species as a "weed," but insofar as that term has a perjorative flavor, it may be misapplied to Straggler Daisy at least in part of its range. It also occurs in open woods and on creek and river banks, which may be the habitats in which it evolved. Besides Straggler Daisy, other common names for *C. vialis* are lawnflower, horseherb, sprawling horseherb, and hierba del caballo.

This brief review documents the geographic distribution of the Straggler Daisy and the dates it has been collected from native and naturalized populations, concluding that an answer to the title's question is equivocal. The species is native to south and central Texas and eastern Mexico (Maps 1 and 2) but apparently recently adventive (non-native, introduced) elsewhere in the state as well as in the USA and outside of North America. Distribution points for maps and dates of collection are from various sources, including herbarium specimens studied first-hand as well as online resources (see Acknowledgements).

Two species constitute the genus *Calyptocarpus* Less. — they have allopatric distributions and the native ranges of both are mostly in Mexico and Central America. Distinctions in morphology were clarified by McVaugh and Smith (1967). Turner et al. (1961) reported chromosome numbers of $2n = 24$ (Oaxaca) and $2n = 72$ (Guatemala) for two populations identified as *Calyptocarpus vialis*, but reexamination of the vouchers by McVaugh and Smith found the hexaploid population to be *C.*

wendlandii. Counts by Solbrig et al. (1972) and Peng and Kao (1984) further confirmed the diploid ($2n = 24$) genome of *C. vialis*.

Calyptocarpus wendlandii Schultz-Bip. (Bot. Zeit. (Berlin) 24: 165. 1866) is native to southern Mexico (Chiapas; records from TEX-LL and XAL via CONABIO/REMIB 2011) and Central America (Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica; Nash & Williams 1976). The type of the species was collected in San José, Costa Rica.

Calyptocarpus vialis Less., Syn. Gen. Compos., 221. 1832. *Synedrella vialis* (Less.) A. Gray, Proc. Amer. Acad. Arts 17: 217. 1882. **TYPE: MEXICO. Veracruz.** "Ad vias pr. Jalapa," Jun 1829, *C.J.W. Schiede s.n.* (presumed holotype: HAL digital image!).

The 1832 protologue, to which publication of the genus and first species is generally attributed, referred to "CALYPTOCARPUS Linnaea VII. ined." and cited "*C. vialis* Linnaea l.c." Other than "Herba Mexicana," no other information about the type was provided. The allusion to "Linnaea VII" may have been in reference to pages 81-82 of editor Schlechtendal's "Litteratur-Bericht" for Linnaea vol. 7 — a brief notice of publication and review of Lessing's "Synopsis Generum Compositarum" — but there was no mention there of *Calyptocarpus*.

Two years later, in an enumeration and description of collections by Christian Julius Wilhelm Schiede from Mexico, Schlechtendal (1834, pp. 269-270) cited "Ad vias pr. Jalapam. Jun. 29." under "221. *Calyptocarpus vialis* Less." A specimen with these data is in Schlechtendal's herbarium at Martin Luther University Halle-Wittenberg and is presumed type material, probably the holotype.

Oligogyne tampicana DC., Prodr. 5: 629. 1836. *Blainvillea tampicana* (DC.) Hemsl., Biol. Cent.-Amer., Bot. 2: 169. 1881. *Calyptocarpus tampicana* (DC.) Small, Fl. S.E. U.S., 1274, 1340. 1903 [as "Calyptrocarpus" tampicanus]. **TYPE: MEXICO. Tamaulipas.** circa Tampico de Tamaulipas, 1827, *Berlandier 61* (presumed holotype: G).

Zexmenia hispidula Buckley, Proc. Acad. Nat. Sci. Philadelphia 1861[13]: 458. 1862. **TYPE: USA. Texas.** Specimen not located. The protologue cited only "Northern Texas. May." Buckley's description seems clearly to refer to *Calyptocarpus vialis* and this would be the oldest known collection of the species from Texas. Strother (1991) listed *Z. hispidula* as a synonym of *C. vialis* but did not provide details of typification.

Calyptocarpus blepharolepis B.L. Rob. (Proc. Amer. Acad. Arts 47: 214. 1911) has been cited as a synonym of *C. vialis* (e.g., Strother 2006) and *C. blepharolepis* was included in J.K. Small's Southeastern Flora (1933). Cronquist (1980), however, correctly observed that the identity of *C. blepharolepis* actually is *Sanvitalia ocymoides* DC. and that the type was collected in Brownsville, Texas — its putative origin from "Tensaw, Alabama" (Baldwin County) in the protologue by Robinson apparently reflecting a label mix-up. A digital image of an isotype of *C. blepharolepis* can be seen on the US type database website.

***Calyptocarpus vialis* in Texas.**

The distribution of early collections of Straggler Daisy in Texas (Map 1) suggests that it is native at least to the southernmost counties of the Rio Grande valley, where it is essentially continuous with the Mexican distribution, and possibly as far north as Austin (Travis County) along the eastern edge of the Edwards Plateau. Occurrences westward, eastward, and northward apparently are more recently adventive. Label observations for a 1930 collection from Bell County (*Wolff 2203*, TEX) note that the species was "gradually moving N from S Texas, possibly through transfer of sod." Shinners (1958) noted that it occurred in Dallas as a lawn weed in St. Augustine grass sod.

***Calyptocarpus vialis* in the USA outside of Texas.**

Outside of Texas, Straggler Daisy has been recorded from **New Mexico** (first report by Spellenberg & Mahrt 1991; Dona Ana Co., collected in 1988 and 2004) and **Arizona** (SEINet 2011; Maricopa Co., collected in 1984 and 2006). In both states, it grows as a lawn weed — it was noted as escaped in Arizona after being brought in with cultivated plants. Inclusion of California in its naturalized range apparently is based on an explicitly cultivated specimen from the University of California-Riverside Botanical Garden in Riverside County (see SEINet 2011).

Eastward from Texas, Straggler Daisy occurs across the Gulf states from **Louisiana** and **Arkansas** through **Mississippi**, **Alabama**, and **Georgia** to **Florida** and **South Carolina** (USDA, NRCS 2011; Weakley 2011; Wunderlin & Hansen 2011). Small (1933) knew it only from Texas and Louisiana, but by 1980 Cronquist (1980) described it as a "Tropical American weed, occasionally introduced in disturbed sites in our coastal states, as in SC, Fla, Ala, and La." Collections from 1931, 1936, and 1937 in Orleans, St. Mary, and Terrebonne parishes, respectively, of southeastern Louisiana indicate that it was established relatively early in that area. Whether it arrived there with horticultural stock from south Texas or from Mexican localities might potentially be determined by molecular study. Other Louisiana collections have been made after 1965. It was collected in Little Rock, Arkansas, as a lawn weed in 1971 (*H.R. Hurst s.n.*, UARK). The oldest collections from Florida were made in major urban areas (Leon Co. 1955, Miami-Dade Co. 1946, Palm Beach Co. 1962); others have been made since 1965. A record for South Carolina is shown by the PLANTS Database (USDA, NRCS 2011; based on the distribution statement by Cronquist 1980), but *Calyptocarpus vialis* is not included in the South Carolina Plant Atlas (A.C. Moore Herbarium 2011).

Straggler Daisy was documented by a 1972 collection in **Illinois** as an apparently naturalized introduction: DeKalb Co., adventive in perennial border in gardens of a DeKalb City residence, where 'it has persisted through 3 growing seasons,' 5 Oct 1972, *Sorensen 7264* (MOR digital image!, VPlants 2011).

***Calyptocarpus vialis* in Mexico and elsewhere.**

Calyptocarpus vialis apparently is native mostly to eastern states of Mexico — Oaxaca north of the Isthmus of Tehuantepec to Puebla, Veracruz, Hidalgo, Querétaro, Guanajuato, San Luis Potosi, Tamaulipas, Nuevo León, and Coahuila (Map 2). The species has apparently recently spread westward into Jalisco and Michoacan (McVaugh 1984) and sporadically into Durango and Sonora (CONABIO/REMIB 2011; SEINet 2011). The occurrence in Guerrero also may be adventive (Atoyac, 1937, *Hinton 10969*, MO digital image!).

The disjunct localities in Yucatan seem likely to be from naturalized plants, as well as those in the West Indies — in Cuba (Alain 1962), Hispaniola (Dominican Republic, Liogier 1966), the Bahamas (Turner 1982). As noted, however, by McVaugh and Smith (1967, p. 271): "We have not seen any Cuban collections collected before 1900, and it is conceivable that the species has been introduced into Cuba within historic time, but it should be remembered that numerous species in various plant families have similar (and presumably native) ranges that include eastern Mexico, Yucatan, and Cuba, but not the rest of the Antilles."

Further distant, *Calyptocarpus vialis* is naturalized in Australia, Taiwan, and Hawaii (Peng & Kao 1984; see Randall 2007 for other references).

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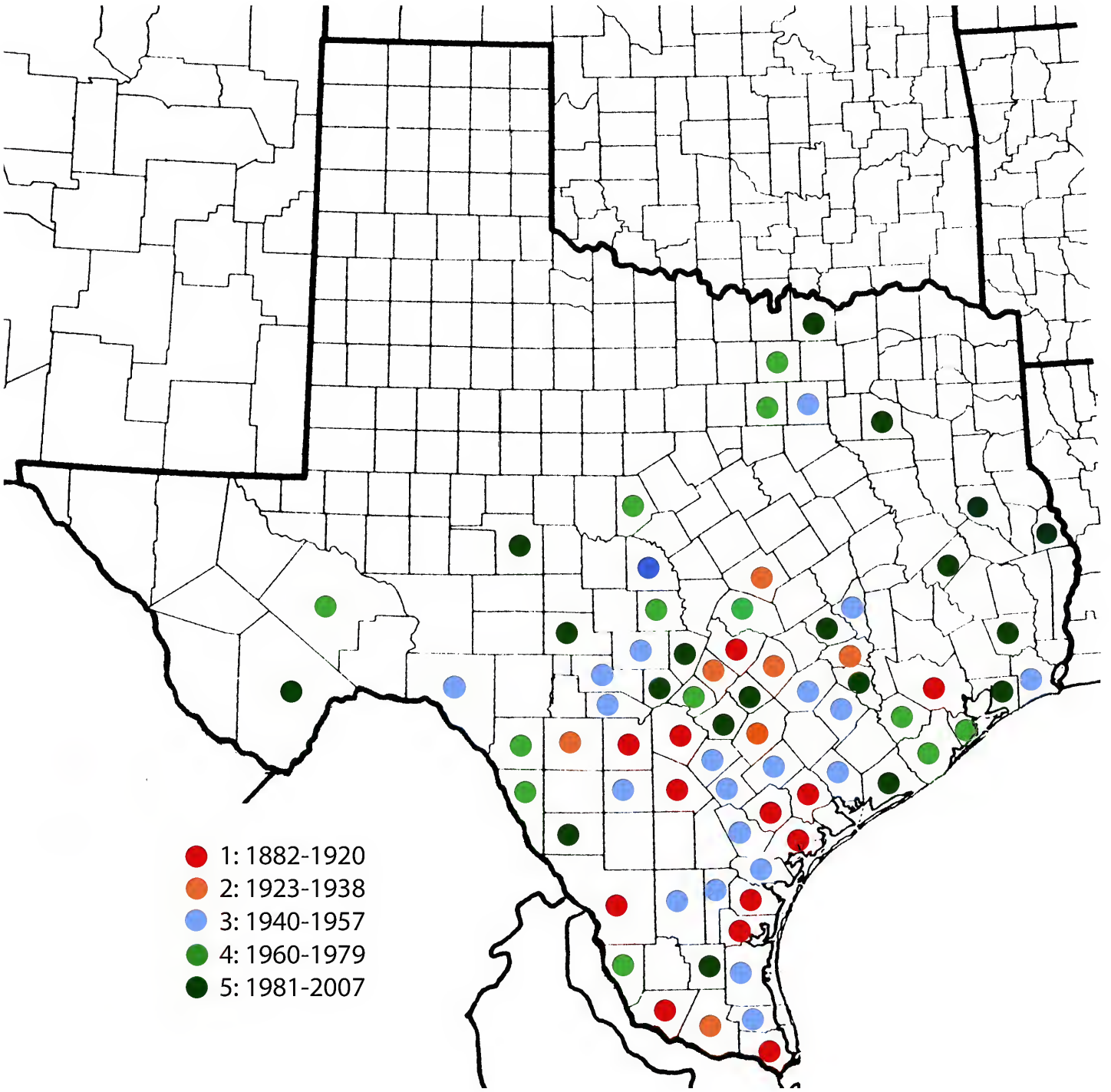


Map 1. Distribution of *Calyptocarpus vialis* in Texas, indicating the date of earliest collection in each county. Ranking of dates is as shown in Table 1. Early collections from Rio Grande counties north to at least Travis County and the apparently continuous distribution northward from Mexico (Map 2) suggest that southern to central Texas is part of the native range of the species.

Table 1. USA counties in which *Calyoptocarpus vialis* has been documented, with the earliest date of collection for each county and ranking (1–5) of date (see Map 1).

TEXAS

Atascosa 1916	1	Fort Bend 1965	4	Matagorda 1983	5
Austin 2005	5	Frio 1944	3	Maverick 1964	4
Bandera 1953	3	Galveston 1974	4	Medina 1884	1
Bastrop 1928	2	Goliad 1900	1	Nacogdoches 2011	5
Bee 1948	3	Gonzales 1926	2	Nueces 1905	1
Bell 1930	2	Grayson 1982	5	Pecos 1974	4
Bexar 1882	1	Grimes 2005	5	Refugio 1915	1
Blanco 1995	5	Guadalupe 1991	5	Sabine 2001	5
Brazoria 1968	4	Hardin 2004	5	San Patricio 1950	3
Brazos 1949	3	Harris 1915	1	San Saba 1950	3
Brewster 1968	5	Hays 1930	2	Starr 1905	1
Brooks 1994	5	Hidalgo 1932	2	Tarrant 1979	4
Brown 1965	4	Jackson 1943	3	Tom Green 1994	5
Burleson 1979	4	Jefferson 1945	3	Travis 1914	1
Caldwell 1983	5	Jim Wells 1943	3	Trinity 2002	5
Cameron 1904	1	Karnes 1952	3	Uvalde 1934	2
Chambers 1990	5	Kendall 1986	5	Val Verde 1947	3
Colorado 1953	3	Kenedy 1953	3	Van Zandt 2000	5
Comal 1974	4	Kerr 1945	3	Victoria 1901	1
Dallas 1952	3	Kimble 2007	5	Washington 1938	2
Denton 1976	4	Kinney 1961	4	Webb 1913	1
DeWitt 1957	3	Kleberg 1920	1	Willacy 1951	3
Dimmit 2001	5	Llano 1973	4	Williamson 1966	4
Duval 1944	3	McLennan 1972	4	Wilson 1949	3
Fayette 1950	3	Madison 1998	5	Zapata 1963	4

ALABAMA

Houston 1994	5				
Mobile 1974	4				
Tuscaloosa 1955	3				

ARKANSAS

Pulaski 1971	4				

FLORIDA

Alachua 1965	4	Highlands 1996	5	Miami-Dade 1946	3
Broward 1999	5	Hillsborough 1985	5	Monroe 2003	5
Citrus 1972	4	Indian River 2001	5	Palm Beach 1962	4
Collier 2000	5	Jefferson 2006	5	Pasco 2001	5
Escambia 1969	4	Lake 1981	5	Pinellas 1979	4
Franklin 1986	5	Lee 1985	5	Polk 1955	3
Gadsden 1969	4	Leon 1955	3	Sarasota 2003	5
Hendry 2006	5	Manatee 1977	4	Volusia 1990	5
Hernando 1979	4	Marion 1985	5		

GEORGIA

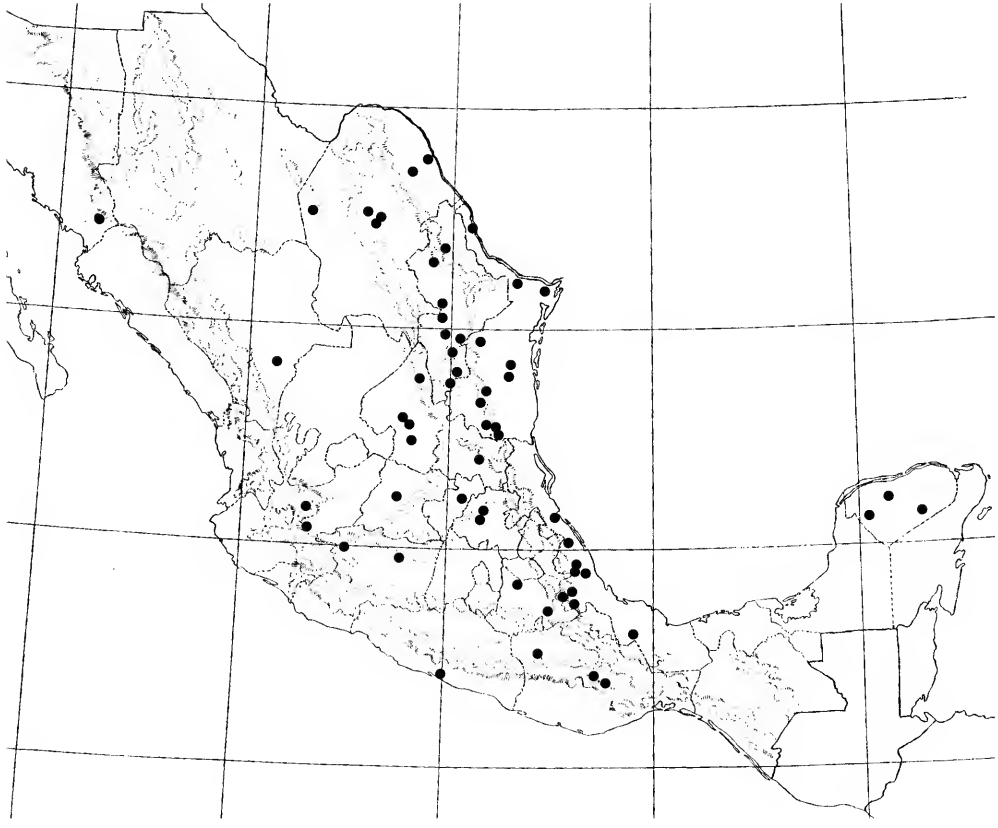
Grady 1969	4				

LOUISIANA

Allen 1982	5	Jefferson Davis 1986	5	St Landry 1971	4
Assumption 1966	4	Lafayette 1957	3	St Mary 1936	2
Caddo 1973	4	Livingston 1974	4	St Tammany 1969	4
Calcasieu 1966	4	Ouachita 1973	4	Terrebonne 1937	2
East Baton Rouge 1970	4	Orleans 1931	2	Washington 1972	4
Iberia 1962	4	St Charles 1969	4		
Iberville 2004	5	St John the Baptist 1992	5		

MISSISSIPPI

Forrest 1969	4	Harrison 1966	4	Stone 1972	4
Hancock 1994	5	Pike 1966	4	Wilkinson 1989	5



Map 2. Distribution of *Calyptocarpus vialis* in Mexico, based mostly on records from TEX-LL and XAL (via CONABIO/REMIB 2011). Localities in Sonora, Durango, Jalisco, Michoacan, Yucatan, and perhaps Guerrero probably are from plants naturalized outside of their native range (see comments in text).

Singhurst, J.R., M. White, J.N. Mink, and W.C. Holmes. 2011. *Castilleja coccinea* (Orobanchaceae): New to Texas. Phytoneuron 2011-32: 1–3.

CASTILLEJA COCCINEA (OROBANCHACEAE): NEW TO TEXAS

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ABSTRACT

Castilleja coccinea, scarlet Indian paintbrush, is reported as new to Texas. The species is known only from Bowie County, which is located in the extreme northeast corner of the Pineywoods Ecoregion of the state. The distribution of *Castilleja* in Texas is briefly discussed and a list of associated flora occurring with the species is presented.
KEY WORDS: *Castilleja coccinea*, Orobanchaceae, Pineywoods, Texas

Recent field study in the Pineywoods region of northeast Texas has resulted in the discovery of the following species, reported here as new to the state. It has been found in two relict prairies in the northeasternmost county of the state.

Castilleja coccinea (L.) Spreng. (Fig. 1)

Voucher specimens: **TEXAS. Bowie Co.**: Godley Prairie, from Simms, 5.5 mi. N of jct. Hwy 98 and Hwy 67 on Hwy 98, W side of Hwy 98, 9 May 2010, *J.R. Singhurst and M. White 18614* (BAYLU); Little Prairie, 0.7 mi. E of jct. of County Road 4107 and County Road 4101 on County Road 4101, S side of County Road 4101, 9 May 2010, *J.R. Singhurst and M. White 18615* (BAYLU).

Until now, nine species of *Castilleja* were known to occur in Texas, with only *C. indivisa* Engelm. and *C. purpurea* (Nutt.) G. Don mapped by Turner et el. (2003) as distributed in northeast Texas. *Castilleja indivisa* is widespread in the eastern half of the state, while *C. purpurea* occurs primarily in the central and north-central part of the state (Nesom 1992). Turner et al. (2003) mapped the species as far east as Lamar County. There is also a record of *C. indivisa* (*Holmes, Singhurst, & Mink 14520*, BAYLU) from Gambill Goose Prairie, 13 km W of Paris, Lamar County, which is about 121 km west of the *C. coccinea* location in Bowie County.

The distribution of *Castilleja coccinea* extends from southern Canada southward throughout the eastern USA (USDA, NRCS 2010). In the West Gulf Coastal Plain region, the species occurs in southeastern Oklahoma (McGregor & Barkley 1977), south central Arkansas (Smith 1988), and central and southwestern Louisiana (Thomas & Allen 1997).

Godley Prairie and Little Prairie are "pocket prairies' in the northeastern edge of the Pineywoods Ecoregion. [A pocket prairie is defined here as a naturally occurring grassland that is located in and surrounded by forest, in this case mixed hardwood and shortleaf pine savannas.] These two prairies have a topography of 1–3% slope with "micro lows" (wetland depressions) and "micro highs" (pimple mounds). The soils of the depressions are typically sandy clays while those of the mounds are sand substrated alfisols. The flora consists of a mixture of midwestern tallgrass and coastal plain herbaceous prairie species. Both prairies are "hayed" yearly.

The dominant flora of Godfrey Prairie and Little Prairie includes *Sporobolus silveanus*, *Tridens strictus*, *Rhynchospora capitellata*, *Scleria pauciflora*, and *Dichanthelium aciculare*. Other prominent herbaceous flora included *Rudbeckia maxima*, *R. grandifolia*, *R. hirta*, *Orbexilum simplex*, *Asclepias hirtella*, *Liatris pycnostachya*, *Helenium flexuosum*, *Andropogon gerardii*, *Helianthus angustifolia*, *H. mollis*, *Allium canadense* var. *hyacinthoides*, *Coreopsis tinctoria*, *Coreopsis basalis*, *Tephrosia onobrychoides*, *Scleria triglomerata*, *Echinacea pallida*, *Physostegia digitalis*, *Silphium laciniatum*, *Pycnanthemum temuifolium*, *Rhexia mariana* var. *interior*, *Andropogon virginicus* var. *virginicus*, *Rhynchospora recognita*, *Sorghastrum nutans*, *Juncus brachycarpus, J. marginatus,* and *Drosera brevifolia*. Other regionally rare species are *Schoenolirion wrightii*, which is extremely abundant, and *Camassia angusta*, which is scattered.

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The authors thank Mr. David Tabolt for access to Little and Godley Prairies.

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Figure 1. *Castilleja coccinea* in Godley Prairie, Bowie County, Texas (photo by Jason Singhurst).

Sivinski, R.C. and M.O. Howard. 2011. A new species of *Linum* from the northern Chihuahuan Desert. Phytoneuron 2011-33: 1–7. Mailed 28 June.

A NEW SPECIES OF *LINUM* (LINACEAE) FROM THE NORTHERN CHIHUAHUAN DESERT

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ABSTRACT

A new species, **Linum allredii** R.C. Sivinski & M.O. Howard, is described from gypsum substrates in the Yeso Hills of the northern Chihuahuan Desert in New Mexico and Texas. It is distinguished from its closest relative, *Linum puberulum*, by its suffrutescent habit, glabrous upper stems and upper leaves, and yellow petal bases.

KEY WORDS: Linaceae, *Linum*, Chihuahuan Desert, gypsophile.

Linum (Linaceae) is usually represented in North America by wide-ranging species. The novelty described here is exceptional and joins a few other narrowly endemic *Linum* species confined to gypsum substrates.

Linum allredii R.C. Sivinski & M.O. Howard, sp. nov. (Figs. 1 and 3). **TYPE: USA. New Mexico.** Eddy Co: Yeso Hills, 10.6 air mi (17.1 km) SW of Whites City and 2.3 mi (3.7 km) N of the Texas border, N32.03419°, W104.44791°, WGS84, 3910 ft.; on pale sandy gypsum of the Castile Formation with *Yucca elata*, *Poliomintha incana*, *Hedyotis nigricans*, *Bouteloua breviseta*, *Tiquilia hispidissima*, *Oenothera hartwegii* subsp. *filifolia*, *Nama carnosum*, *Amilocaulis lemolemus* var. *gypsogemus*, *Mentzelia humilis*, *Zeltnera maryanna*, *Polygala alba*; several thousand plants along ridge; always perennial and occasionally producing shoots from large, laterally extending, woody roots; petals orange or salmon with a broad darker or reddish band in the lower interior half above 1-2 mm of yellow at the base – making a round yellow 'eye' at the basal center of the corolla around the ovary; 22 Apr 2011, *M.O. Howard with R.C. Sivinski MOH-132* (holotype: UNM; isotypes: ASU, BRIT, CAS, F, GH, MO, NMC, NY, RM, RSA, SRSC, TEX, US, UTEP).

A *L. puberulo* (Engelm.) Heller habitu suffrutescenti, caulibus distaliter glabris, foliis distalibus glabris, et centris corollarum flavis differt.

Long-lived perennial, suffrutescent from a woody branching base, sometimes sprouting shoots from thick, lateral roots. **Stems** erect, up to 25 cm tall, puberulent or glabrescent at the base and glabrous for at least the distal two-thirds. **Leaves** linear to linear-lanceolate, appressed; lower and mid-cauline leaves mucronate, entire, glabrous or weakly puberulent on the margins or midribs, 3–10(–12) mm long; upper leaves acuminate-aristate, serrulate with teeth usually gland-tipped, glabrous, 3–7 mm long. **Stipular glands** dark and present throughout. **Inflorescence** a terminal, few-flowered panicle. **Sepals** lanceolate, acute-aristate, prominently 1-nerved at the midrib, margins serrulate with gland-tipped teeth, glabrous, deciduous in fruit, 4.5–7 mm long. **Petals** broadly obovate, 10–13 mm long, 6–7 mm wide, orange or salmon with a broad adaxial dark orange or

reddish band across the lower half above a short yellow band in the lowest 1–2 mm. **Stamens** 5.5–7 mm long; anthers yellow, 1.2–1.6 mm long. **Styles** 7–9 mm long, united to just below the 5 dark stigmas. **Capsules** oval, stramineous, 3.7–4 mm long, dehiscing into five 2-seeded segments, translucent false septa of segments complete. **Seeds** reddish brown, minutely reticulate, 2.4–2.7 mm long, 0.9–1.1 mm wide.

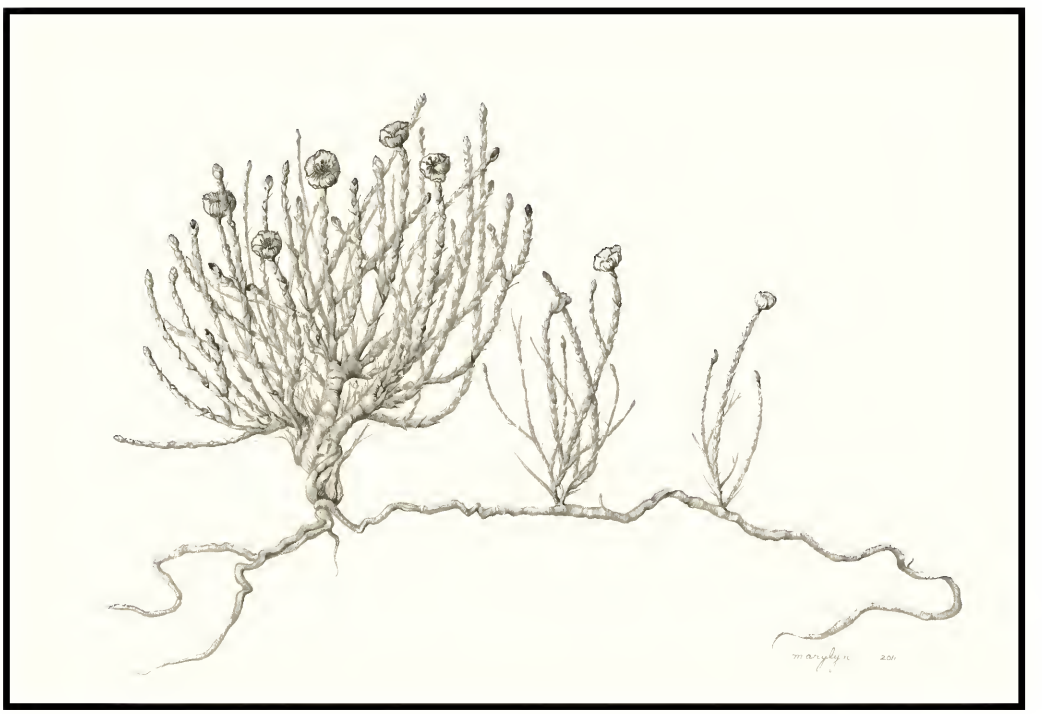

Figure 1. *Linum allredii*, drawn from *Howard with Sivinski MOH-132* (NY).

Additional Specimens. USA. New Mexico. Eddy Co.: Approximately 32 miles SW of Carlsbad, BLM-Yeso Hills Research Natural Area, T26S R24E S27 SE¼ of SW¼, 3900 ft., 21 May 1992, *Dunmire 1215* (UNM); Yeso Hills, 13.8 air miles SW of Whites City and 0.15 miles N of the Texas border, N32.00509°, W104.49105°, WGS84, 3910 ft., 30 Jul 2008, *Sivinski 6839* (BYU, NMCR, COLO); Yeso Hills, 13.7 air miles SW of Whites City and 0.25 miles N of the Texas border, N32.00375°, W104.49342°, WGS84, 3900 ft., 26 Aug 2010 (in fruit), *Sivinski 7779* (UNM); Yeso Hills, 11.9 air miles SW of Whites City and 0.12 miles NW of Hwy 62/180, N32.02916°, W104.48198°, WGS84, 3915 ft., 22 Apr 2011, *Sivinski with Howard 7976* (UNM); same as type location, 16 May 2011 (in fruit), *Howard MOH-135* (NMC, NMCR). **Texas**. Culberson Co.: approximately 16 air miles SW of Whites City, NM, 2.2 miles S of the junction of U.S. Highway 62/180 and Texas Ranch Road 652, N31.97106°, W104.51560° NAD83, 3895 ft., 16 May 2011, *Howard MOH-134* (SRSC).

Etymology. *Linum allredii* is named for Kelly W. Allred, outstanding floristic botanist, agrostologist, bryologist, teacher, and expert at finding and cataloging the plants of New Mexico during his long career as professor of botany in the Animal and Range Science Department at New Mexico State University in Las Cruces.

Distribution and Habitat. This new species of flax is currently known only from the Yeso Hills, which occupy an area of approximately 13,000 hectares on the border of New Mexico and Texas between the Guadalupe Mountains and Pecos River. The Yeso Hills comprise a small northern portion of the "Gypsum Plain" that represents the surface exposure of the Permian-aged Castile Formation located between the Guadalupe and Delaware Mountains on the west and the Pecos River in New Mexico and Rustler Hills in Texas on the east (Porch 1918; King 1948; Weber & Kottlowski 1959). Estimated size of the outcropping of the Gypsum Plain is approximately 260,000 hectares and extends approximately 95 km north to south, and from 8 to 50 km wide east to west (Anderson et al. 1997; Barnes et al. 1992).

The Gypsum Plain was described by King (1948) as a wide grassy plain dissected by broad swales that narrow in their upper reaches to shallow canyons with narrow entrenched side canyons that drain eastward to the Pecos River. Superimposed upon the swale/canyon drainage system on most of the western half of the Gypsum Plain is a series of southwest to northeast trending linear scarps. These scarps are from 5 to 15 km in length and are often paired and parallel with a broad swale between them. They likely represent an older drainage system caused by fracturing of the formation (King 1948) and are clearly identifiable on aerial imagery (Fig. 2). In addition to swale/canyon margins and scarps, topography of the Yeso Hills area includes numerous gypsum hills of various sizes on the margins of the Gypsum Plain and within the swales and canyons.

Linum allredii appears to be a gypsophilic endemic of the scarps, gypsum hills, and swale/canyon margins of the Gypsum Plain. This species is further limited in distribution to those topographic features that expose a layer of pale, sandy, biologically crusted gypsum that is much lighter in color than the gray more heavily crusted gypsum of adjacent strata. Indeed, the population at the type locality extends in a thin band along light-colored gypsum at the top of a scarp for a distance of over 3 km. Paratype collections on gypsum hills or swale/canyon margins were from smaller outcrops of similar light-colored gypsum. While collections of *L. allredii* are thus far limited to the Yeso Hills, the actual extent of the species may reach further south into the Gypsum Plain of Texas. The numerous scarp lines visible on satellite imagery well south of our southernmost collection suggest the possibility of additional *L. allredii* populations in those areas (Fig. 2).

Linum allredii densities at locations seen by the authors in the Yeso Hills range from sporadic hillside groups of a few dozen to a long, narrow population of several thousand individuals along the scarp at the type locality.

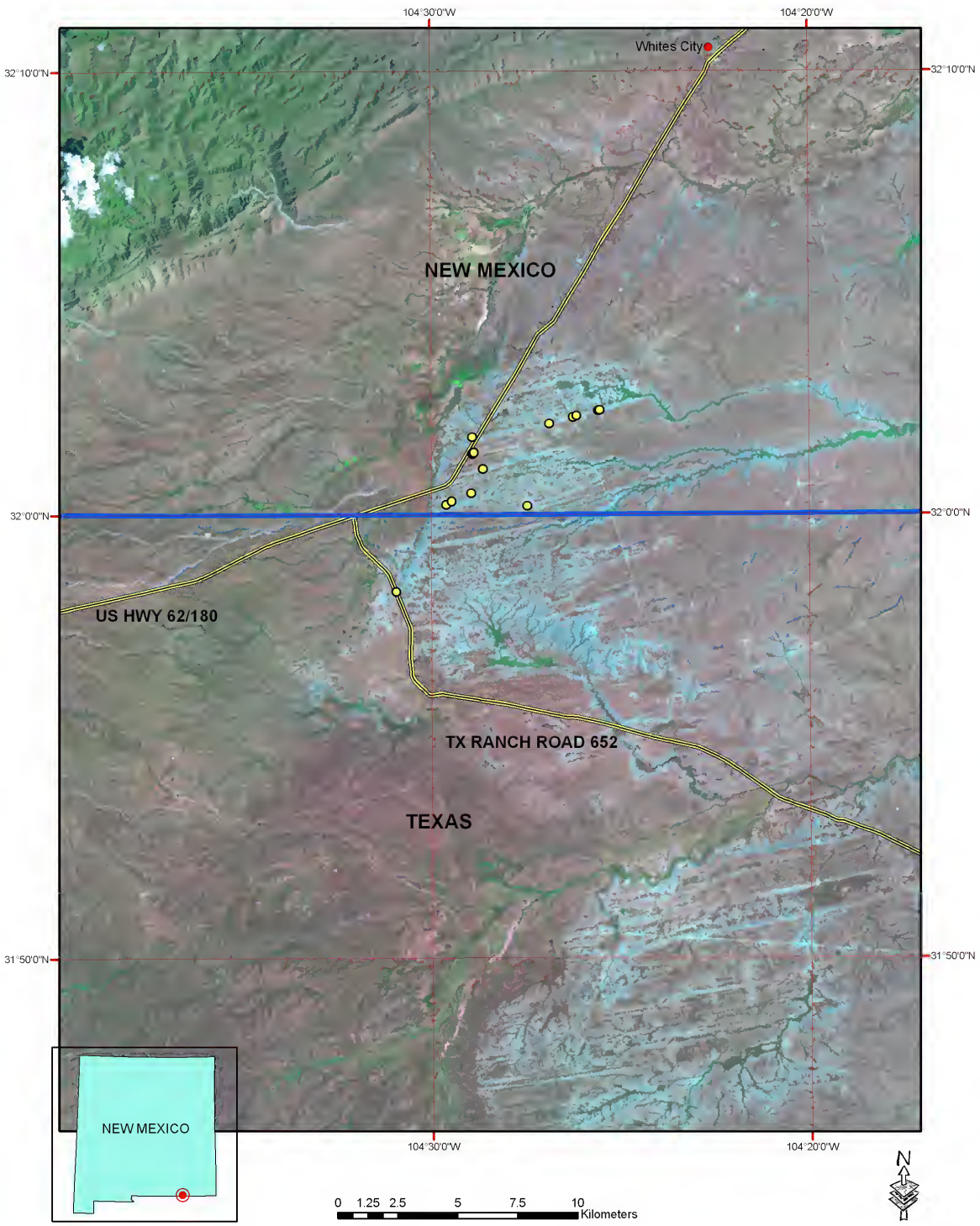

Figure 2. Landsat 7 image overlaid with the distribution of *Linum allredii*. Yellow points indicate collections. Light blue areas represent outcrops of gypsum scarps and hills in the Castile Formation. Primary roads are the yellow lines and the state border is a blue line.

Morphological distinction of the new species *Linum allredii* belongs to the yellow- to orange-flowered *Linum* sect. *Linopsis* subsect. *Rigida* and to the 5-parted fruit series *Rigida*. It is a strong perennial with a woody, branching base and thick lateral roots. Its short, appressed, aristate leaves, gland-toothed and aristate sepals, orange petals with reddish markings, and fine, short, slightly retrorse pubescence are most similar to *L. puberulum* (Engelm.) Heller, which is common and widespread in the southwestern USA and northwestern Mexico. *Linum puberulum* occurs on a variety of soil types, including gypsum, and is sympatric with *L. allredii* in the Yeso Hills. *Linum puberulum* differs most obviously by its puberulent upper stems and upper leaves and its mostly annual habit. It rarely overwinters as a weak perennial and in those cases retains a slender taproot and does not become woody. *Linum allredii* is consistently glabrous in the distal stems and leaves — if glabrescent or puberulent then only on the lower few centimeters of stem and lowest leaves.

The ability to reproduce asexually by sprouting shoots from lateral roots up to 3 dm away from a parent plant is unique to *Linum allredii* in *Linum* series *Rigida*. Perennial habit in the species of this series is rare and the other perennials do not root sprout. Asexual reproduction in *L. allredii* is interesting but not considered diagnostic because it is more a capability than a tendency. Most individuals remain solitary while only a few sprout multiple clones from lateral roots in response to environmental influences such as soil structure or surface erosion. Approximately 20% of a sample of 106 plants studied at the type locality exhibited surface evidence of distant sprouting and caudex development along lateral roots.

Figure 3. *Linum allredii* habit and flowers. Yeso Hills, Eddy County, New Mexico, 31 July 2008.

Linum allredii is an attractive plant with larger floral measurements than most nearby *L. puberulum* populations in New Mexico and Texas. The flowers of each species are readily distinguished by their petal color patterns. The lower interior half of the *L. allredii* corolla is usually a broad reddish or dark orange band above 1–2 mm of yellow at the base of each petal. This makes a round yellow 'eye' at the basal center of the corolla around the ovary (Fig. 3). The corolla of *L. puberulum* is dark at the center because the interior lower half of the petal is reddish and lacks yellow at the base. The yellow-centered orange corolla of *L. allredii* is similar to the corolla color pattern in some forms of *Linum berlandieri* W.J. Hook., which also occur in the northern Chihuahuan Desert region. The annual taprooted habit, larger, attenuate, usually 3-nerved sepals, longer longest leaves (>10 mm), and stouter lower stem hairs of *L. berlandieri* readily separate it from *L. allredii*.

Linum gypsogenum Nesom and *Linum modestum* C.M. Rogers are also yellow- or orange-flowered perennials and narrow endemic species confined to local gypsum deposits, but in the Mexican state of Nuevo León (Nesom 1983; Rogers 1984). Their separated styles and fruits dehiscing into 10 one-seeded segments distinguish them from *L. allredii*, which has the united styles and fruits dehiscing into 5 two-seeded segments that are characteristic of the *Linum* series *Rigida*.

KEY TO *LINUM* SERIES *RIGIDA* IN THE NORTHERN CHIHUAHUAN DESERT REGION

1. Sepals entire or erose, not glandular-toothed ..... **Linum hudsonioides** Planchon
1. Sepals serrulate with gland-tipped teeth.

2. Stems and leaves (at least on the midribs), proximal to distal, markedly puberulent; taprooted annuals or weak perennials ..... **Linum puberulum** (Engelmann) Heller
2. Stems and leaves glabrous throughout or only the proximal sometimes pubescent; taprooted annuals or perennials with woody bases.

3. Plants long-lived perennials, suffrutescent from a branching woody base and thick lateral roots; longest leaves usually 10 mm or less ..... **Linum allredii** Sivinski & Howard
3. Plants taprooted annuals without woody bases; longest leaves 6-30 mm.

4. Sepals tending to persist in fruit; translucent false septa of capsule segments incomplete, inner margin a loose fringe ..... **Linum vernale** Wooton
4. Sepals deciduous in fruit; false septa complete, not fringed on the inner margin.

5. Lower stems glabrous; leaves usually small and inconspicuous; sepals linear-lanceolate ..... **Linum aristatum** Engelmann
5. Lower stems usually sparsely or minutely pubescent; leaves conspicuous; sepals lanceolate.

6. Lower stems minutely and sparsely puberulent; sepals acute-aristate, prominently 1-nerved at the midrib, marginal nerves inconspicuous; petals yellow or orange-yellow without darker or reddish marks below the middle ..... **Linum australe** Heller
6. Lower stems sparsely hirsutulous; sepals attenuate, usually 3-nerved; petals orange or yellow-orange with darker or reddish marks below the middle.

7. Stigmas pale; sepals green ..... **Linum berlandieri** W.J. Hooker var. **berlandieri**
7. Stigmas dark; sepals grayish or purplish ..... **Linum berlandieri** var. **filifolium** (Shinners) C.M. Rogers

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A COMMENTARY ON *CHEILANTHES LANOSA* (PTERIDACEAE) IN TEXAS

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ABSTRACT

Based on a historical collection (1925) from McLennan County, Texas, by E.T. Wherry, *Cheilanthes lanosa* (Pteridaceae) is substantiated as a natural member of the flora of the state. A review of the published accounts of the species in Texas is also included.

KEY WORDS: *Cheilanthes*, Pteridaceae, Texas, E.T. Wherry

Cheilanthes lanosa (Michx.) D.C. Eaton (Pteridaceae) has been long recognized as a component of the Texas flora (Eaton 1859; Bush 1903; Cory and Parks 1937; Correll 1949, 1956, and others). Treatments of the species for Texas by Diggs et al. (1999, 2006), however, have questioned whether the species is actually a part of the Texas flora, especially as its primary range is more northern and eastern. The major centers of distribution are concentrated in the Appalachian and Ozark highlands of the United States (USDA, NRCS 2011). The present paper, through literature review and a search for a supporting specimens, resolves this question.

The accounts of *Cheilanthes lanosa* in Texas began with Eaton (1859) in the Report on the United States and Mexican Boundary Survey, where the new combination *C. lanosa* was proposed for the plant originally known as *Nephrodium lanosum* Michx. The listing of this species in Texas was based upon [*Charles*]*Wright s.n.* collected "Along the Rio Grande."

Reverchon (1903) included the names of 51 ferns and 15 fern allies in his checklist of the fern flora of Texas. Neither *Cheilanthes lanosa* nor its synonyms, *Nephrodium lanosum* Michx. and *Cheilanthes vestita* Sw., were included.

Bush (1903) included *Cheilanthes lanosa* in his list of ferns of Texas (p. 351). He stated that "No specimen of this species has been seen from Texas, and it is included on the authority of Britton & Brown's [1896] Illustrated Flora." Lucien M. Underwood (1896), who contributed the treatment of the pteridophytes in that work, did not indicate the basis for including Texas as part of the distribution of the species.

In a Catalogue of the Flora of the State of Texas, Cory and Parks (1937) cited *Cheilanthes lanosa* as occurring in two of the then recognized plant areas (ecoregions) of Texas (see map on page 2). One is area 7, described as Plains Country, which consisted of the areas now delineated as the Rolling Plains (area 8) and the High Plains (area 9) in Gould (1962, 1969). The second is area 4, cited as the Blackland Prairie. Cory and Park's area 4 consisted of the areas in Gould (1962, 1969) recognized as the Post Oak Savannah, the Blackland Prairies, and Cross Timbers and Prairies, where they are numbered as areas 3, 4, and 5, respectively. The source (specimen or reference) for the inclusion in either area was not given and the report by Cory and Parks must be considered unsubstantiated.

In 1949, Correll cited the distribution of *Cheilanthes lanosa* as "McLennan County. Only one locality known for Texas," thus refuting the Eaton (1859) record. Later, Correll (1956), in Ferns and Fern Allies of Texas, presented partial data of the now sole Texas record as "McLennan Co., Harrison, *E.T. Wherry s.n.*" Neither the date of collection nor herbarium where the specimen is accessioned was included. [In this work, dates and herbaria are not included as part of the listings of exsiccatae. A list of herbaria consulted is on page 16, which also includes a statement that the treatment is based upon these materials (i.e., the specimens cited).] Correll (1956) provided adequate documentation of the collection of the species within the state, which carried the "force of authority." Since then, and doubtless based upon Correll (1956), *C. lanosa* has been included as part of the vascular flora of the state (Correll & Johnston 1970; Hatch et al. 1990; Johnston 1990; Turner et al 2003; etc.). The species was also treated as occurring in Texas by Windham and Rabe (1993), where it is mapped as distributed in the northeast part of the state, rather than the disjunct location in McLennan County of east-central Texas.

Recent treatments of *Cheilanthes lanosa* for the state by Diggs et al. (1999, 2006) raised "the possibility that the species is not part of the TX flora." The idea seems to have resulted from the lack of a reference and/or adequate citation of a specimen in Cory and Parks (1937) and Correll (1949, 1956), making confirmation of the reports difficult. Additionally, failure to recognize that the collector of the specimen was Edgar Theodore Wherry may have contributed to this reasoning. Wherry, former professor of Botany at the University of Pennsylvania, was author of over 400 publications, which included such classics as the Fern Guide (1961) and Southern Fern Guide (1964). That the Wherry collection was unnumbered (as are all of Wherry's individual collections that we canvassed) and was collected barely six miles from Baylor University, led to the assumption that the specimen was in the Baylor University Herbarium (see Diggs et al., 1999, 2006). Reference to the list of herbaria consulted by Correll (1956), which does not include Baylor University, would have invalidated that assumption.

A visit to the United States National Herbarium (US) by the senior author in May, 2011, resulted in locating the Wherry specimen (Figure 1). The label on this specimen is a "stock" label with the data, other than the header "PLANTS OF TEXAS" and the binomial, written in the script of an unknown person (Wherry?). The binomial is written in the hand of William R. Maxon (fide Gregory McKee) in a pen with a broad nib. The envelope contains several additional fronds and fragments. Aside from the stamp of the U.S. National Herbarium and the accession number (1466623), the only other item on the sheet is an annotation by Donovan S. Correll, dated 1947, confirming the determination as *Cheilanthes lanosa*. This is the specimen, referred to by Correll (1949, 1956), that documents the presence of *C. lanosa* in Texas. It is also the only known record for the species in the state.

Finally, attempts to relocate the species in nature were unsuccessful. The Harrison area, which was visited several times, is a highly impacted Blackland Prairie consisting of clay soils of 1—3 % slopes. Exposed rocks, ledges, cliffs, or rocky ridges, all prime locations for *Cheilanthes lanosa*,

could not be located either by ground search or by reference to period maps or aerial photographs. The preceding, when combined with the proximate location given by Wherry, abundance of quarries from surface mining of gravel and sand, and stringent Texas trespass laws, couple to make the possibility of relocation doubtful at best.

Figure 1. *Cheilanthes lanosa* (*E.T. Wherry s.n.*, US). Photo courtesy Gregory McKee of the United States National Herbarium.

Finally, attempts to relocate the species in nature were unsuccessful. The Harrison area, which was visited several times, is a highly impacted Blackland Prairie consisting of clay soils of 1—3 % slopes. Exposed rocks, ledges, cliffs, or rocky ridges, all prime locations for *Cheilanthes lanosa*, could not be located either by ground search or by reference to period maps or aerial photographs. The preceding, when combined with the proximate location given by Wherry, abundance of quarries from surface mining of gravel and sand, and stringent Texas trespass laws, couple to make the possibility of relocation doubtful at best.

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We thank the United States National Herbarium for the courtesies extended to WCH during his visit. Gregory McKee of that organization assisted the senior author and also provided the digital photograph. Darrell Vodopich of the Department of Biology, Baylor University, prepared the photograph for publication. We also thank Alina Freire-Fierron, Collections Manager of the Herbarium, Botany Department, Academy of Natural Sciences, Philadelphia (PH), for her efforts in searching for the E.T. Wherry specimen. Tom Zanoni (NY) commented on and searched for *Cheilanthes lanosa* specimens from Texas accessioned in the New York Botanical Garden. Robert Baldridge of the Baylor University Department of Biology assisted with the attempts to relocate *Cheilanthes lanosa* near Harrison.

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OXYLOBUS SUBGLABER KING & H. ROB. (ASTERACEAE: EUPATORIEAE) — ACCEPTANCE OF ITS SPECIFIC STATUS

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ABSTRACT

Oxylobus subglaber, treated as a synonym of *O. arbutifolius* by Turner and Kerr (1985) in their revision of the genus, is resurrected to specific rank, this a result of additional specimens collected from the general region of the type locality. *Oxylobus* was previously treated as having but 4 species; the present reestablishment and the previous description of the novelty *O. preecei* by Turner (1988) now brings the total to 6 species. A key to the taxa is provided, along with a map showing the distribution of the revised set of accepted species.

KEY WORDS: Asteraceae, Eupatorieae, *Oxylobus*, Mexico

Oxylobus (Moc. ex DC.) A. Gray is a genus positioned in the subtribe Oxylobinae of the Eupatorieae, along with eight other genera, most notably *Ageratina* Spach (Hind & Robinson 2009). The present reassessment of the group was occasioned by the resurrection of *O. subglaber* and the need to account for the recently described *O. preecei*. So constructed, the genus now contains six well marked species, as follows.

1. Flowering stems with mostly 2–5 pairs of basal leaves; perennial herbs ..... **Oxylobus adscendens** (Sch. Bip. ex Hemsl.) B.L. Rob. & Greenm.
1. Flowering stems with mostly 10 or more pairs of leaves; suffruticose herbs or subshrubs.

   2. Involucres 3–4 mm high; peduncles not markedly glandular pubescent.

      3. Involucral bracts broadly rounded apically; pappus of achenes 0.2 mm long or less ..... **Oxylobus subglaber** King & H. Rob.
      3. Involucral bracts acute apically; pappus of achenes 0.3-0.5 mm long ..... **Oxylobus oaxacanus** Blake

   2. Involucres 4.3–7.0 mm high; peduncles markedly glandular pubescent.

      4. Leaf blades mostly 2.2–6.0 cm long, 1–3 cm wide, densely pubescent ..... **Oxylobus glandulifer** (Sch. Bip. ex Hemsl.) A. Gray ex Klatt
      4. Leaf blades mostly 1–2 cm long, 0.5–1.2 cm wide, sparsely pubescent to glabrous or nearly so.

         5. Leaves to some extent glandular pubescent; heads not borne on elongate naked scapes ..... **Oxylobus arbutifolius** (Kunth) A. Gray
         5. Leaves glabrous; heads borne on elongate naked scapes .... **Oxylobus preecei** B.L. Turner

Turner and Kerr (1985) provided a detailed account of four of the above species; the two species added to the genus since are enlarged upon below. Distribution of the two additional taxa are shown in Fig. 3.

OXYLOBUS PREECEI B.L. Turner, Phytologia 65: 375. 1988. Fig. 1. **TYPE: MEXICO. Pueblo.** Mpio. Coxcatlan, W of Tepeloya, ca 22 km from Coxcatlan, ca 2560 m, 15 Apr 1985, *P. Tenorio L. 8804* (holotype: TEX).

As can be noted in the sketch of the present novelty by Turner (1988), the habit of *Oxylobus preecei* is very similar to *O. subglaber*. It differs from the latter in numerous characters, including shape and size of the involucral bracts and characters of the pappus. Turner speculated that *O. preecei* might have been derived from "ancestral hybridization" between *O. arbutifolius* and *O. oaxacanus*, since it combines features of both taxa.

OXYLOBUS SUBGLABER King & H. Rob. [as *Oxylobus 'subglabrus'*], Phytologia 27: 385. 1973. **TYPE: MEXICO. Oaxaca.** Distrito Ixtlan, Cerro de Humo Chico, 2 Sep 1966, *T. Macdougall 8* (holotype: US!).

Additional collections examined. MEXICO. Oaxaca. Distrito Ixtlan, Near Cerro Pelon, 59 km SW of Valle National … on open cliff, 28 Sep 1994, *Yahara & Soejima 118* (TEX); 32.9 km N from Ixtlan along Mexico Hwy 175 to Valle Nacional, 2780 m, "Road-cut in edge of dense pine forest," 17° 30.3' N, 96° 30.4' W, 10 Nov 1997, *Yahara et al. 1100* (TEX).

Specimen observations along with label data on the two Yahara collections, "On open cliff," and along "Road-cut," suggest that the species is a bluff-dwelling species having a low, stoloniferous habit.

Oxylobus subglaber, originally known by a single collection from north-central Oaxaca, Mexico, was placed by Turner and Kerr (1985) in synonymy with the widespread and highly variable *O. arbutifolius* (Kunth) A. Gray; they noted, however, that the plant concerned was an "unusual form" of *O. arbutifolius*. Indeed, the senior author (BLT) subsequently studied the type in more detail (cf. Fig. 2), noting that its specific status might be "good." This has proved to be the case, to judge from the additional collections assembled by Yahara et al.

Both of the more recent collections are very similar to the type of *Oxylobus subglaber* in habit, foliage, and floral details. In my early assessment of the taxon, as noted above, I compared it with *O. arbutifolius*, but it is clearly closer to *O. oaxacanus* Blake and the recently described, local endemic *O. preecei* B.L. Turner from Pueblo. Both of the latter possess similar habits and capitulescences, but *O.preecei* is readily distinguished from *O. subglaber* by having distinctive, oblanceolate, leaves, longer, linear-lanceolate involucral bracts, and more pronounced pappus scales.

ACKNOWLEDGEMENTS

Thanks to US for a loan of type material of *Oxylobus subglaber*, to Tom Wendt for the photograph of *O. preecei*, and to Guy Nesom for helpful suggestions on the manuscript. Distribution maps are based upon specimens on file at LL-TEX.

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Figure 1. Holotype of *Oxylobus preecei* (TEX).

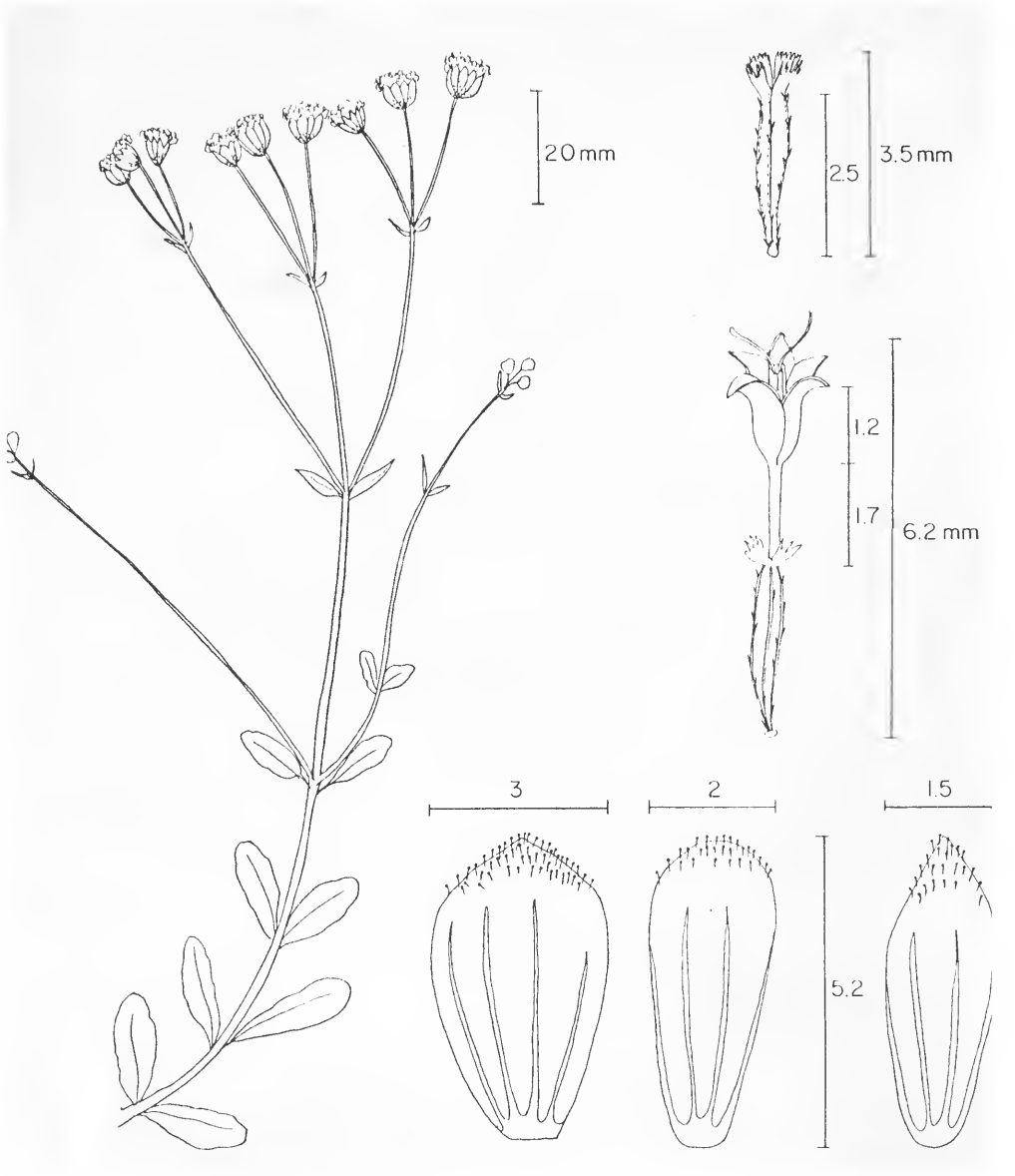

Figure 2. Sketches of *Oxylobus subglaber* (from holotype).

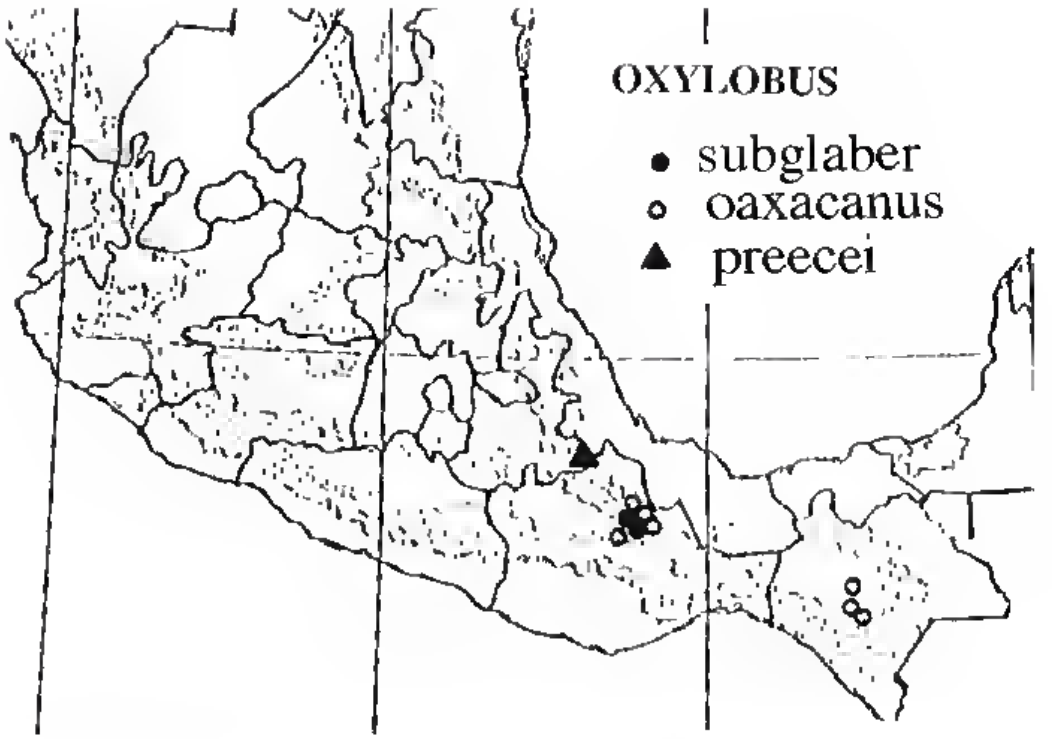

Figure 3 Distribution of *Oxylobus oaxacanus*, *O. preecei*, and *O. subglaber* — Puebla, Oaxaca, and Chiapas

Nesom, G.L. and J.F. Pruski. 2011. Resurrected species of *Erigeron* (Asteraceae: Astereae) from Central America. Phytoneuron 2011-36: 1–10.

RESURRECTED SPECIES OF *ERIGERON* (ASTERACEAE: ASTEREAE) FROM CENTRAL AMERICA

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ABSTRACT

Four species are resurrected from synonymy of the widespread *Erigeron karvinskianus* DC. The Costa Rican *E. irazuensis* Greenm. is known from the Cerros Escazú, Volcán Barva, and Volcán Irazú. The Costa Rican and Panamanian *E. maxonii* Blake is widespread in the Cordillera Talamanca, reaching as far south as Volcán Barú in Panama. These two species are similar to *E. karvinskianus*, which is native to Mexico and Central America but which also occurs widely as an adventive in subtropical regions of South America and other parts of the world. Two other related species, *E. pacayensis* Greenm., from Guatemala and western Honduras, and *E. aquarius* Standl. & Steyerm., endemic to Honduras, have rarely or never been recognized in previous treatments. A key, map, and descriptions distinguish these five Central American species. Along with the Mexican endemics *E. heteromorphus* B.L. Rob., *E. fluens* Nesom, and *E. barbarensis* Nesom & Van Devender, this set of species comprises *Erigeron* sect. *Karvinskia*.

KEY WORDS: *Erigeron karvinskianus*, *Erigeron irazuensis*, *Erigeron maxonii*, *Erigeron pacayensis*, *Erigeron aquarius*, Astereae, Central America

Erigeron karvinskianus DC. in Central America was treated broadly by D'Arcy (1975) and Nash (1976), but significant variation has escaped notice in such an inclusive view. This species, which probably occurs natively only in Mexico and Central America, and a group of lesser known close relatives have been recognized as *Erigeron* sect. *Karvinskia* Nesom (Nesom 1989, 2008), one of relatively few groups of *Erigeron* whose evolutionary radiation has been restricted to Mexico and Central America. Three of the species are endemic to Mexico: *E. heteromorphus* B.L. Rob., *E. fluens* Nesom, and *E. barbarensis* Nesom & Van Devender. The remaining five species of the section, including a new species described here, are restricted to Central America (Fig. 1).

Each of the four Central American endemics has a distinct morphology and a well-defined geographical range. Each differs from *Erigeron karvinskianus* in producing filiform ligules, a generally greater number of ray florets, and longer phyllaries. The resurrected species described here are distinctive in features of habit, vestiture, and leaf morphology. We provide a synopsis, with a key, descriptions, and map of the Central American species of *Erigeron* sect. *Karvinskia*.

Key to Central American species of *Erigeron* sect. *Karvinskia*

1. Stem vestiture spreading to deflexed.

2. Stems arising from long (3–12 cm), fibrous-rooted, rhizomelike caudex branches; leaves attenuate to a narrow petiole region 1/3–1/2 the leaf length, not at all clasping, margins with 2–4 pairs of evenly spaced crenate-serrate teeth or shallow, acute lobes; rays not coiling; Volcán Irazú, Volcán Barva, and Cerros de Escazú in Costa Rica ..... **Erigeron irazuensis**
2. Stems arising directly from a short rhizome; leaves basally attenuate but epetiolate, at least the mid-stem subclasping, margins entire or less commonly with 1–2 pairs of shallow serrations or acute lobes on the distal half; rays coiling; western to south-central Honduras ..... **Erigeron aquarius**

1. Stem vestiture antrorsely appressed to ascending.

3. Leaves linear to linear-oblanceolate ..... **Erigeron pacayensis**
3. Leaves elliptic to obovate or spatulate-obovate.

4. At least the mid-stem leaves subclasping, margins commonly 2–4-toothed or -lobed; involucres 4.8–6.8 mm long; phyllaries purple-tinged, usually with a golden sheen, with prominently broad, scarious margins; rays filiform, 0.1–0.3 mm wide; disc corollas 3.3–4.5 mm long; achenes 1.5–1.9 mm long; Cordillera Talamanca in Costa Rica to Panama ..... **Erigeron maxonii**
4. Leaves not at all clasping, margins 0–1(–2)-toothed or -lobed; involucres 2.5–5 mm long; phyllaries greenish-brown, dull, with narrow margins; rays broader, (0.5–)0.8–1.3 mm wide; disc corollas 2.3–3.3 mm long; achenes 1–1.4 mm long; Guatemala and Honduras, rare as adventive in Costa Rica ..... **Erigeron karvinskianus**

ERIGERON AQUARIUS Standley & Steyermark, Publ. Field Mus. Nat. Hist, Bot. Ser. 22: 301. 1940. **TYPE**: **Guatemala**. Depto. Sacatepéquez: slopes of Volcán de Agua, above Santa María de Jesús, 2250-3000 m alt., moist forest, 11 Feb 1939, *P.C. Standley 65053* (F digital image!).

Plants suffruticulose perennials from a short, slender, lignescent, fibrous-rooted rhizome. **Stems** 1-several from the base, erect, 15–50 cm tall, 2–6 branched from midstem or above, greenish, moderately hirsute-pilose with deflexed trichomes 0.2–0.6 mm long, eglandular. **Leaves** cauline, basal absent at flowering, tufts of small leaves rarely present in leaf axils, green, secondary venation often prominently visible, oblanceolate to elliptic-oblanceolate, 1.8–4 cm long, 2–8 mm wide, relatively even-sized along the stems, basally attenuate but epetiolate, subclasping, margins entire or less commonly with 1–2 pairs of shallow serrations or acute lobes on the distal 1/2, narrowly revolute or slightly thickened, ciliate with spreading hairs on the proximal half. **Heads** on peduncles 5.5–8 cm long; involucres 7–9 mm wide, 4.8–5.5 mm high; phyllaries in 3–4 subequal series or graduate and the outer half as long as the inner, lanceolate to narrowly elliptic-oblanceolate with acute to long acuminate apices, 0.3–0.4 mm wide, midrib golden-brown, midregion greenish-brown with brown lateral stramineous zones, sparsely strigose with thin-based trichomes not prominently flattened or twisted, sparsely to moderately minutely glandular; receptacles flat to shallow convex. **Ray florets** 80–180 in 1–2 series, corollas 6–8 mm long, white, drying white or purple-tinged, without a midstripe, nearly filiform, laminae 0.2–0.3 mm wide, coiling at maturity. **Disc florets**: corollas 3.4–4.5 mm long. **Achenes** ca 1.6 mm long, 2-nerved, sparsely strigose; pappus of 18–24 bristles, with a few outer setae 0.2–0.3 mm high.

Flowering at least Jul–Sep, probably longer. Meadows, thickets, pine-sweetgum forests; 1500–2000 m; western to south-central Honduras.

Additional collections examined. **HONDURAS**. **Depto. La Paz**: near Guajiquiro, 14º 07' N, 87º 50' W, secondary area, open forest, *Quercus*, *Pinus*, 1900–2000 m, 23 May 1993, *Liesner 26502* (MO). **Dept. Morazán**: Mt. Uyuca, 5500 ft, 3 Jul 1948, *Glassman 1861* (NY, UC); Cerro de Uyuca, along trail from Las Flores to La Labranza, moist meadow, 1600–1750 m, 17 Aug 1949, *Standley 22821* (GH); Cerro de Uyuca, trail between Las Flores and La Labranza, common in wet thicket, 1500–1575 m, 8 Sep 1949, *Standley 23498* (F, GH, NY, UC). **Dept. Ocotepeque**: El Moral on Cordillera Merendón, pine-*Liquidambar* forest, 1600 m, 27 Aug 1968, *Molina R. 22247* (NY).

Erigeron aquartius is characterized by erect stems single from the base and branching at midstem or above, arising from a fibrous-rooted rhizome, spreading-deflexed stem vestiture, cauline leaves mostly entire and even-sized, heads on long (5.5–8 cm) naked peduncles, granular-glandular phyllaries, long (3.4–4.5 mm) disc corollas, and filiform, coiling rays. The collections cited here are from three separated areas within Honduras.

ERIGERON IRAZUENSIS Greenman, Proc. Amer. Acad. Arts 40: 36. 1904. **LECTOTYPE** (Nesom & Boufford 1990): Costa Rica. Volcán Irazú, La Playita, endroits humides, 3300 m, 31 Jan 1900, *H. Pittier 14075* (GH! Figure 2; isolectotypes: "hb. Physico-Geogr. Cost. Ri. [CR?]," F digital image!, US! digital image!).

Plants herbaceous perennials, probably taprooted (taproots not collected), producing long (3–12 cm), fibrous-rooted, rhizomelike caudex branches. **Stems** erect to procumbent, 6–25 cm, 0–2-branched, greenish, sparsely to moderately or densely pilose with vitreous, irregularly spreading hairs 0.5–1.0 mm, sometimes deflexed on the proximal third of the stem, eglandular. **Leaves** cauline, basal mostly absent at flowering, clusters of axillary leaves absent, oblanceolate to spatulate-obovate, 2–4 cm long, 5–10 mm wide, relatively even-sized upward or the basal and lowermost slightly wider and more spatulate, attenuate to a narrow petiole region 1/3–1/2 the leaf length, not at all clasping, margins with 2–4 pairs of crenate-serrate teeth or shallow, acute lobes, apices indurate-mucronulate, margins flat or barely revolute, both surfaces moderately hirsute-pilose with erect-ascending hairs. **Heads** on peduncles 2–5 mm long; involucres 6(–7) mm high, 8–11 mm wide (pressed); phyllaries in 2(–3) subequal series, lanceolate with acute to acuminate apices, thin, greenish yellow to golden brown, inner wth purple tips and with 3 orange veins often prominent, margins scarious, sparsely hirsute-pilose with vitreous trichomes, eglandular. **Ray florets** 38–55 in 1–2 series, corollas 5–6 mm long, usually erect, white to pinkish, usually drying with purple tips or upper surfaces, without a midstripe, laminae filiform, 0.1–0.3 mm wide, not coiling. **Disc florets**: corollas 3.2–3.8 mm long. **Achenes** 1.3–1.5 mm long, 0.3–0.4 mm wide, 2-nerved, sparsely strigose; pappus of 18–22 bristles, with a conspicuous outer series of setae 0.3–0.6 mm high.

Flowering at least Feb–May, probably longer. Roadsides, roadbanks, disturbed sites, pastures; 2200–2800 m; central Costa Rica on at least the S, W, and N slopes of Volcán Barva (peak at 2906 m), Volcán Irazú (peak at 3753 m), and Cerros de Escazú (highest peaks are Cerro Rabo de Mico (2428 m), Cerro Cedral (2420 m), Cerro Pico Alto (2353 m), Cerro Pico Blanco (2271 m), and Cerro San Miguel (2035 m).

Specimens examined. **COSTA RICA**. **Prov. Cartago**: cratere de l'Irasu, RR, sur les roches de gris volcaniques, ca. 3300 m, 30 Mar 1888, *Pittier 152* (GH). **Prov. Heredia**: Cantón de Barva, Parque Nacional Braulio Carrillo, Cordillera Central, de Estación Barva a Finca La Georgiana, en area dentro del Parque, en pastos, 2200 m, 30 May 1993, *Fernández 1093* [basal leaves only] (MO); SW, W, and N slopes of Volcán Barva, along road from Sacramento to Colonia Jesús María,

disturbed roadside, 2650–2810 m, 29 Apr 1986, *Grayum 7505* (MO); Cordillera Central, N of Sacramento, bank by side of road, ca. 2500 m, 25 Feb 1984, *Khan et al. 1291* (MO); Parque Nacional Braulio Carrillo, 1 km al N de Sacramento, camino al Puesto Barva, 2300 m, 1 May 1990, *Rivera 248* (MO); Cantón de Barva, Cuenca del Tarcoles, 2 km de Sacramento, ruta al Volcan Barva, Parche de Bosque junto a la carretera, común en paredones a orilla del camino, 2500 m, 13 May 1997, *Rodríguez 2164* (MO). **Prov. San José**. Z.P. Cerros de Escazú, bosque secundario en la cima y falda norte del Alto Hierbabuena (Cerro Daser) en la vereda a la quebrada Suarez 7 Cucubres, 2300-2000 m, 3 Oct 1993, *Morales 1845* (TEX); Las Nubes, wet open banks, ca. 1500-1900 m, procumbent in dense masses, rays pink, common, 20-22 Mar 1924, *Standley 38406* (GH).

Erigeron irazuensis is distinct in its long (3–12 cm), fibrous-rooted, rhizomelike caudex branches, hirsute-pilose stems, and relatively short, oblanceolate to spatulate-obovate, conspicuously toothed to lobed leaves. Presumably it would be contrasted in identification with *E. maxonii*, which is its closest geographic neighbor. The northern terminus of the range of *E. maxonii* is in the Cordillera de Talamanca near the Savegre River basin, about 40 kilometers south of Volcán Irazú of the Central Cordillera and separated by the relatively lowland Cartago Valley.

Before it became clear that *Erigeron irazuensis* occupies a restricted geographical range, Nesom identified and annotated specimens in various herbaria as this, but those collections are identified here as *E. maxonii*.

ERIGERON KARVINSKIANUS DC., Prodr. 5: 285. 1836. **TYPE**: **Mexico**. Without definite locality or date, *Karvinsky s.n.* (M, not seen).

Erigeron mucronatus DC., Prodr. 5: 286. 1836. *Erigeron karvinskianus* DC. var. *mucronatus* (DC.) Aschers., Verh. Bot. Ver. Prov. Brandenb. Jahre 1899, 41: 37. 1900 [Ost. Bot. Zeit. 50: 22/23. 1900; a reference to the first publicaton]. *Erigeron karvinskianus* DC. var. *mucronatus* (DC.) Hiern., Bot. Jahrb. Syst. 28: 585. 1901, nom. illegit. comb. superfl. **TYPE**: **Mexico**. "Mexique," no other data (type material: G-DC, photo GH!, photo and fragment UC!).

Erigeron gaudichaudii DC., Prodr. 7: 274. 1838. **TYPE**: **Peru**. "In Peruvia ex herb. Gaudichaud."

Erigeron heterophyllus Kunth & Bouché, Ind. Sem. Hort. Berol., 11. 1845, nom. illegit. non. Muhl. ex Willd. (1803).

Erigeron leucanthemifolius Schauer, Linnaea 19: 723. 1847. **TYPE**: **Mexico**. "In Mexico," *Aschenborn 88*. "Proximus certo E. karwinskiano (DC. 5. 285. n. 11.), sed hirsutie diversus."

Vittadinia triloba Hort. ex J. Rudolph, Rev. Hort. 76: 315. 1904, non DC. (1836). Rudolph wrote the article ascribing the description (in French) to 'Hort.'

Felicia erigeroides sensu auct. non DC. (1836) (fide Raphael, Pap. Proc. Roy. Soc. Tasmania 89: 148. 1955).

Plants perennial, herbaceous to suffruticulose, roots woody, sometimes with an evident taproot, caudex usually simple, stems sometimes rooting adventitiously. **Stems** erect to sprawling or decumbent, 10–100 cm long, sparsely strigose to glabrate, eglandular, commonly producing tufts of small leaves in the axils of larger ones. **Leaves** basal and cauline, basal deciduous before flowering, cauline elliptic to obovate, not clasping, mostly 1–4(–5) cm x 5–13 mm, entire or with 1–2 pairs of acute, mucronulate teeth or shallow lobes on the distal margins, usually relatively even-sized along the stems, sparsely and loosely strigose to hirsute villous, eglandular. **Heads** 1–5, diffusely arranged, usually from long branches from above midstem on peduncles 2.5–13 cm long; involucres 2.5–4 mm high, 7–10 mm wide; phyllaries in 3–4 subequal to graduate series, often basally fused into a narrow ring, sparsely strigose to hirsute-villous or glabrate, eglandular to minutely glandular. **Ray florets** 45–80, 5–11 mm long, white, sometimes drying pinkish, laminae (0.5–)0.8–1.3 mm wide, not coiling

or slightly coiling. **Disc florets**: corollas 2–3.3 mm long. **Achenes** 1–1.4 mm, 2(–4)-nerved, sparsely strigose; pappus of 15–27 bristles, with a few outer setae 0.2–0.3 mm high. $2n = 18, 27, 36$.

Flowering all year but most abundantly in spring and summer (Mar–Sep). Moist to wet habitats, often rocky cliff faces or ravine slopes, various types of vegetation, often in areas of oak or pine, often in cut-over or second-growth areas. Probably native to Mexico and Central America; widely cultivated and naturalized in California (USA), Europe, Africa, India, east Asia, New Zealand, Hawaii, and a number of other Pacific islands. Plants at medium elevations in South America and the Greater and Lesser Antilles probably are non-native, at least in the sense that the species is not autochthonous there. The collection from Prov. San José, Costa Rica (cited below) probably documents an adventive.

Representative collections (Central America): **COSTA RICA**. **[Prov. San José:]** camino desde San Antonio–Escazú hasta Pico Blanco, 31 Aug 1983, *Gómez 20733* (MO). **EL SALVADOR**. **Depto. Santa Ana**: Cantón Potrero Grande arriba (Volcán de Santa Ana), 1600 m, 9 Jun 1989, *Martinez 279* (MO); Depto. Chalaltenango, Bosque de El Pital, 2000–2700 m, 5 Aug 1976, *Montalvo 4794* (MO). **GUATEMALA**. **Depto. Alta Verapaz**: Coban, 1350 m, Dec 1906, *von Turckheim 11721* (GH, MO). **Depto. El Quiche**: Nebaj, rocky hill ca. 4 km W, 6700 ft, 11 Jun 1964, *Contreras 4952* (LL). **Depto. Huehuetenango**: low hills along Rte 9N, ca 5 mi N of Huehuetenango, 17 Jul 1960, *King 3399* (TEX); San Juan Ixcoy, Captzin, orilla de la carretera, 3200 m, 15 Mar 2000, *Veliz et al. 7938* (MO). **Depto. Quezaltenango**: mountain along National Rte 9N, ca. 27 mi N of Quezaltenango, 16 Jul 1960, *King 3387* (TEX). **Depto. San Marcos**: 10 mi S of San Marcos along road from San Rafael, 2100 m, disturbed forest, 2100 m, 13 Jul 1977, *Croat 41020* (MO). **Depto. Santa Rosa**: Sabaneta, 6500 ft, May 1893, *Heyde & Lux 4518* (GH-2 sheets). **Depto. Sololá**: 15 km S of Panajachel, S of Lake Atitlan, 2200 m, 8 May 1972, *Burch 5916* (MO). **Depto. Totonicapán**: region of Chui-quisis, above T on road to Desconsuelo, pine-oak thicket, 2500-2800 m, 23 Jan 1941, *Standley 84384* (MO). **HONDURAS**. **Depto. Intibuca**: forest around Balneario Espanol of La Esperanza, 22 May 1970, Barkley & Hernandez R. 40330 (GH). **Depto. Fco. Morazán**: entre Santa Lucía y Valle de Angeles, bosque de nubes, floresta de Montana Grande, 1800 m, 26 Sep 1950, *Molina R. 3321* (GH); SW of San Juancito, bosque nebuloso de montaña, La Tigra, 2000 m, 14 Jul 1961, *Molina R. 10124* (GH, MO).

ERIGERON MAXONII S.F. Blake, Contr. U.S. Natl. Herb. 22: 594. 1924. **TYPE**: **Panama**. Eastern slope of Chiriquí Volcano, open brushy slopes, Cuesta Grande, 2600–2990 m, 11–13 Mar 1911, *W.R. Maxon 5306* (holotype: US! digital image!; isotypes: GH!, NY! digital image!, US!).

Erigeron chiriquensis Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 126. 1940. **TYPE**: **Panama**. Prov. Chiriquí, Boquete District, Volcán de Chiriquí, Potrero Muleto, open areas, alt. 3140 m, 18 Jul 1938, *M.E. Davidson 872* (holotype: F digital image!; isotypes: GH!, MO!, US! digital image!).

Plants suffruticose perennials from a woody taproot. **Stems** usually several from the base, erect to procumbent, 17–45 cm tall, usually 1–5 branched, purple or reddish, sparsely strigose to hirsute-pilose with appressed to ascending or spreading hairs 0.1–1 mm long and often variable in orientation on a single stem, eglandular. **Leaves** cauline, basal absent at flowering, clusters of axillary leaves absent, spatulate-obovate, the lower 2.5–7.5 cm long, 5–12 mm wide, attenuate to a petiole region 1/3–1/2 the leaf length, with 2–4 pairs or serrate teeth or shallow, acute lobes on the distal 2/3, gradually reduced upwards and becoming lanceolate, epetiolate, subclasping, and more shallowly lobed to entire, apices indurate-mucronulate, margins very narrowly revolute and ciliate with ascending hairs. **Heads** on peduncles 5–55 mm long; involucres 5.2–6.8 mm high, 9–14 mm wide; phyllaries in 3–4 graduate series, outermost ca. 1/2 as long as the inner, lanceolate with acute to

acuminate apices, thin with 3 orange veins often prominent on the inner, inner wth purple tips, margins scarious and minutely lacerate-ciliate, sparsely strigose-pilose with flattened, vitreous, ascending trichomes 0.5–1.2 mm long, eglandular. **Ray florets** 40–115 in 1–2 series, corollas usually erect to ascending-erect, white to pinkish or dark red, usually drying with purple tips or upper surfaces, without a midstripe, laminae filiform, 0.1–0.3 mm wide, not coiling. **Disc florets**: corollas 3.3–4.5 mm long. **Achenes** 1.5–1.9 mm long, 0.4–0.5 mm wide, 2-nerved, sparsely strigose; pappus of 15–23 bristles, with a conspicuous outer series of setae 0.2–0.5 mm high.

Flowering all year except perhaps in late Sep–Nov. Rock faces, oak woods, thickets, or open areas of paramo; (1700–)2000–3820 m; central Costa Rica to western Panama (Volcán Barú).

Representative collections examined. **COSTA RICA**. **Prov. San José**: Cerro de la Muerte, 3300-3700 m, 20 Jun 1991, *Delprete 5081* (TEX); Cerro de la Muerte, 20 Apr 1947, *Fosberg 27305* (MO, NY); Cantón de Pérez Zeledón, Parque Nacional Chirripó, Cordillera de Talamanca, Valle Los Conejos, 3400 m, 27 Jul 1996, *Gamboa et al. 472* (MO); Cantón de Pérez Zeledón, P.N. Chirripó, 3400 m, 3 May 1997, *Gamboa R. 1305* (MO); La Muerte Massif, km 110 on Rte 2, 3000–3300 m, 18 Jan 1983, *Gómez 19715* (MO, TEX); Cerro de la Muerte, along Interamerican Hwy (Rt 2), SE of road to radio towers, roadside, 3200-3300 m, 2 Jan 1987, *Hill 17570* (GH); between KM 90-91 on Rte 2 between Cartago and San Isidro, 3400 m, 4 Jan 1988, *Holmes 4889* (TEX); Cerro del Muerte region, Cordillera de Talamanca, lower S slope of Cerro Zacatal[es], 3220 m, 21 Apr 1985, *Horn 162* (WIS); N side of Cerro de la Muerte, 3 Jan 1979, *Pruski 438* (TEX); summit on Cerro de la Muerte, 27 Aug 1967, *Raven 22073* (DS); Cantón de Dota, Los Santos, Cuenca del Savegre, 500 m de la Carretera Interamericana, entrando hacia San Gerardo, 2600 m, 17 Apr 1998, *Rodríguez et al. 3280* (MO); along Interamerican Hwy ca. 25 km SW of road to La Cima and 4.1 km NW of Cerro Asunción, 3180-3220 m, 11 Sep 1979, *Stevens 14273* (MO); Sierra de la Muerte, KM 88 S of San Jose on Interamerican Hwy., 8 Aug 1981, *Turner 15035* (TEX); KM 75 S of San Jose on Interamerican Hwy., 8 Aug 1981, *Turner 15040* (TEX); Chirripó massif, Pico Sureste, Dec 1966, *Weston 3610* (UC); S to SW of Cerro Chirripó, above Sabana, Rio Talari, 10 Dec 1966, *Weston 3691* (UC); Chirripo massif, Valle de los Lagos, 7 Sep 1969, *Weston 6065* (UC); Chirripó massif, Valle de los Conejos, 26 Jan 1976, *Weston 10078A* (UC). **Prov. Cartago-San José**: near Asunción at summit of the Interamerican Hwy, open paramo on exposed slopes and ridges, 3200 m, 15 Mar 1973, *Burger and Gentry 8534* (MO); edge of the paramo ca. 2 mi NW from La Asunción on the Carr. Interamericana, *Wilbur 17383* (DUKE, NY); 2.4 km NW of La Asunción on Interamerican Hwy., 7 Aug 1977, *Wilbur 24089* (CAS, DUKE); Cartago, base of Cerro Asunción, 15 Dec 1979, *Wilbur 28885* (CAS, DUKE, MO); Cartago, base of Cerro de la Muerte, Cordillera de Talamanca along Panamerican Hwy, 3200 m, 1 Feb 1965, *Williams et al. 28812* (GH, LL). **Prov. Limón**: Chirripó Natl. Park, paramo between Casa de Administración and peak, ca. 3400 m, 13 Feb 1983, *Garwood et al. 1175* (MO); Parque Nacional Chirripó, Del Puesto Los Crestones, 2.5 km al sur, camino a "La Sabana de los Leones," 3200 m, 29 Mar 1988, *Robles 1770* (MO). **PANAMA**. **Prov. Chiriquí**: summit and SW face of Cerro Copete, 9000 ft, 29 Jul 1947, *Allen 4884* (MO-2 sheets); Volcán Barú, above Yen Finca, Boquete District, 8000 ft, 17 Mar 1979, *Averett et al. 1060* (MO); Potrero Muleto vicinity, around upper rim, 18 May 1976, *Croat 34944* (MO); summit of El Barú, 3400 m, 13 Mar 1979, *D'Arcy and Hammel 12426* (MO); N side of Cerro Pavón on Paseo Respingo, 8400 ft, 4 Apr 1979, *D'Arcy et al. 12942* (MO); Volcán de Chiriquí, Dist. Boquete, open areas, 7000 ft, 11 Jul 1938, *Davidson 870* (GH); Volcán Barú, trail up from meadows between Volcan and Bambito, 1700–2100 m, 22 Jul 1985, *deNevers 6023* (MO); E side of Volcán Barú, 3000 m to summit, 24 Jul 1975, *Mori and Bolten 7436* (MO); vicinity of Boquete, Finca Collins, "El Velo," 6150 ft, 11 Mar 1963, *Stern et al. 1960* (MO); Volcán de Chiriquí, Potrero Muleto to summit, 13–15 Jul 1940, *Woodson & Schery 397* (GH, MO).

A variant expression of *Erigeron maxonii* occurs at 1100–2000 meters in the vicinity of Volcán Barú in western Panama. Typical *E. maxonii* occurs in the same immediate area, at the

southern end of its overall range, but generally at higher elevations, (1700–)2400–3400 meters. Like *E. maxonii*, the variants are short-lived perennials with ascending stems, appressed stem pubescence, and gold-colored phyllaries with broad scarious margins but the plants have linear-oblanceolate, non-clasping leaves and relatively smaller heads, florets, and achenes.

Specimens of the variant examined. **Prov. Chiriquí**: vicinity of Bambito, 30 May 1970, *Croat 10621* (MO-2 sheets); Boquete, 3800 ft, 13 May 1938, *Davidson 647* (GH, MO); Los Llanos, near Volcán, tussock field, ca. 2000 m, 3 Jun 1986, *McPherson 9270* (MO); Chiriquí Viejo Valley, 1 May 1938, *White 101* (GH, MO); vicinity of Boquete, 1200–1500 m, 24-26 Jul 1940, *Woodson & Schery 776* (GH-2sheets, MO).

Several collections from the same area are intermediate between the variant and typical *Erigeron maxonii*: **Prov. Chiriquí**: Loma Larga to summit, Volcan de Chiriquí, 2500-3380 m, 4-6 Jul 1938, *Woodson et al. 1051* (GH, MO, NY) and *Woodson et al. 1069* (GH, NY); Casita Alta to Cerro Copete, 2300–3300 m, 10 Jul 1940, *Woodson & Schery 363* (MO-2 sheets); Potrero Muleto to summit, Volcan de Chiriquí, 3500-4000 m, 13-15 Jul 1940, *Woodson & Schery 397* (GH). Plants of *Woodson & Schery 363* have larger heads of *E. maxonii* but narrow, entire to barely serrate cauline leaves. Those of other collections also have relatively large heads as well as pinnatifid to coarsely toothed, relatively broad leaves. Further study, especially in the field, may clarify the biological status of these variants.

ERIGERON PACAYENSIS Greenman, Publ. Field Columb. Mus., Bot. Ser. 2: 266. 1907. **LECTOTYPE** (Lowden, Taxon 19: 22. 1970): **Guatemala**. Dept. Amatitlán, crater of Volcán Pacaya, 8300 ft, 6 Jan 1907, 6 Jan 1907, *W.A. Kellerman 611* (F digital image!; isolectotypes: GH!, US! digital image!).

Erigeron deamii B.L. Rob., Proc. Amer. Acad Arts 45: 410. 1910. **TYPE**: **Guatemala**. Fiscal, growing under rocks in canyon, 3700 ft, 3 Jun 1909, *C.C. Deam 6159* (holotype: GH! photo ENCB!; isotype: MICH digital image!).

Erigeron tripartitus S.F. Blake, Brittonia 2: 337. 1937. **TYPE**: **Guatemala**. Dept. Suchitepequez, S slope of Volcán Atitlán, 7500 ft, decaying trunk at top of forested ridge, 14 Jan 1935, *A.F. Skutch 2124* (holotype: GH!; isotype: US! digital image!).

Plants suffruticulose perennials from a woody, usually horizontal, fibrous-rooted rhizome or from a taproot. **Stems** erect, 1-numerous, branching from near the base, 6–55 cm long, moderately to sparsely strigose with trichomes 0.2–0.8 mm long, eglandular. **Leaves** cauline, basal deciduous before flowering, linear to linear-oblanceolate, 1-nerved, 10–35(–65) mm long, 1–3(–6) mm wide, attenuate to a petiolar region, margins sometimes widely variable on a single plant, entire or with 1–2(–3) pairs of mucronulate-tipped teeth or linear lobes, often very narrowly revolute, not clasping, relatively even-sized along the stems, sparsely strigose above and beneath. **Heads** solitary on peduncles 2.8–4.8(–9) cm long; involucres 3.5–5 mm high, 6–10 mm wide; phyllaries in 3–4 subequal to graduate series or the outermost ca. half the length of the inner, inner 0.3–0.5 mm wide, often basally fused into a narrow ring, sparsely strigose, eglandular, tips sometimes purplish. **Ray florets** (50–)80–120 in 1–2 series, corollas 4–5 mm long, laminae 0.1–0.3 mm wide, white, maturing or drying pink to purplish, not coiling or reflexing at maturity, tube often hispid-pilose with sharp-pointed trichomes. **Disc florets**: corollas 2.3–3.3 mm long; style branches 0.3–0.5 mm long, including the shallowly triangular collecting appendages. **Achenes** 1.3–1.5 mm long, 0.3–0.4 mm wide, 2(–3)-nerved, sparsely strigose; pappus of 17–23 bristles, with a few outer setae 0.2–0.4 mm long.

Flowering (Apr–)Jun–Jul(–Dec) or all year. Roadsides, road cuts, usually in disturbed vegetation, oak-pine; 1000–2800 m; Guatemala to western El Salvador.

Representative collections examined. **EL SALVADOR**. **Dept. Santa Ana**: Cerro Verde, camino a las brumas (ahora San Blas), 20 Mar 1993, *Montalvo 6251* (MO). **GUATEMALA**. **Dept. Amatitlán**: Volcan de Pacaya, 7 Apr 1921, *Tonduz 496* (MO). **Dept. Chichecastenango**: between Chichicastenango and Los Encuentros, 2050 m, 9 Jul 1991, *Stall 9* (TEX); Utitlán, 16 km from Chichecastenango, 19 Jun 1938, *von Schrenk s.n.* (MO). **Dept. Chimaltenango**: Hwy CA1 between turnoff to Patzún and Sololá, 14.8 mi NNW of turnoff of Patzún, 2480 m, 13 Feb 1987, *Croat and Hannon 64757* (MO); 7.6 km E of Patzún, 2000 m, 21 Jun 1970, *Harmon & Dwyer 2585* (MO); on CA1, 6.3 km W of Chimaltenango, 1925 m, 1 Jan 1992, *Prather 1038* (TEX); 24 mi W of Chimaltenango, W of Guatemala City, pine-oak, roadside cut, 8100 ft, 12 Aug 1975, *Wallace et al. 436* (MO). **Dept. El Quiche**: Joyabáj, 4500 ft, Apr 1890, *Heyde & Lux 4510* (MO); ca. 4 mi E of Sacapulas on Rte 7W toward Copan, pine woodland on steep slopes, 1825 m, 27 Dec 1991, *Soule 2974* (TEX). **Dept. Guatemala**: upper slopes of Vocan Pacaya just below cone on N side, 2200 m, 23 Aug 1970, *Harmon 4150* (NY). **Dept. Huehuetenango**: Canyon of Río Seligna, in "El Tapon" near Monos bridge, 40 km NW of Huehuetenango, 1000–1200 m, 14-17 Dec 1972, *Williams et al. 41157* (MO, NY). **Dept. Quetzaltenango**: ca 7 mi W of Quezaltenango on Natl. Rte 1, 2 Jul 1960, *King 3183* (TEX, NY); along road to Quetzaltenango, ca. 23 km S of Quetzaltenango, 4500 ft, 16 Jun 1976, *King 7024* (MO, NY); near Quezaltenango, 7500 ft, 1 Jul 1963, Nickerson s.n. (TEX); 4 km N of Santa Maria Planta Electrica on Hwy 9s, 2000 m, 31 Jul 1965, *Roe et al. 747* (MO). **Dept. Sacatepequez**: 2.3 mi SW of Alotenango on road from Antigua to Escuintla, 1300 m, 26 Jul 1977, *Croat 41965* (MO); 8.4 road km NE of Antigua Guatemal en route to Parramos, 1650 m, 1 Jan 1992, *Prather 1023* (TEX); Chillani, 1450 m, 3 Apr 1921, *Rojas 312* (MO); ca. 3 mi W of Cd. Vieja on rte. 3 toward Yepocapa, 25 Oct 1977, *Stuessy & Gardner 4365* (WIS). **Dept. San Marcos**: 15 km al E de San Marcos, bosque mesofilo, 11 Mar 1991, *Hernandez 2541* (TEX) and *2544* (TEX). **Dept. Sololá**: 3 mi above Panajachel on road to Patzicía around Lake Atitlán, 1750 m, 14 Jul 1977, *Croat 41065* (MO); ca. 20 mi E of Quetzaltenango on Rte. CA1, 2850 m, 2 Jan 1992, *Soule 3041* (MO, TEX). **Dept. Totonicapán**: ca. 10 km W of center of Totonicapán, 2400 m, 8 Apr 1986, *Gereau & Martin 1859* (MO); jct rte. CA-1 and road to San Franciso el Alto (ca. 1.8 mi N of San Cristobal Totonicapán), 24 Oct 1976, *Stuessy & Gardner 4333* (WIS). **HONDURAS**. **Depto. Morazán**: camino viejo entre Tegucigalpa y Suyapa, colinas pedregosa barro colorado, 1100 m, 6 Nov 1948, *Molina R. 1451* (GH).

All collections of *Erigeron pacayensis* except two apparently have all been from the western half of Guatemala (south of Petén). The collection from western El Salvador is from Cerro Verde, a relatively small volcano immediately southeast of Volcán de Santa Ana (Llamatepec), the highest volcano in the country (the peak is at 2381 meters). The collection from Depto. Morazon in Honduras is unambiguously identified but appears to be considerably disjunct.

Two collections have been studied that may reflect hybridization between *E. pacayensis* and *E. karvinskianus* in a region where they are sympatric: **Dept. Quetzaltenango**, ca. 7 mi W of Quetzaltenango, 2 Jul 1960, *King 3183* (TEX); **Dept. Solola**, mountains along National Rte 1, between Solola and Panajachal, 5 Jul 1960, *King 3224* (TEX). These plants have filiform rays but leaves broader than characteristic of *E. pacayensis*. The type of *Erigeron tripartitus*, from the same region, is a tall plant with leaves with deeply cut, narrowly lanceolate lobes and may also be such a hybrid. *King 3224* is a voucher for a hexaploid chromosome count of n = ca. 27 (Turner et al. 1960).

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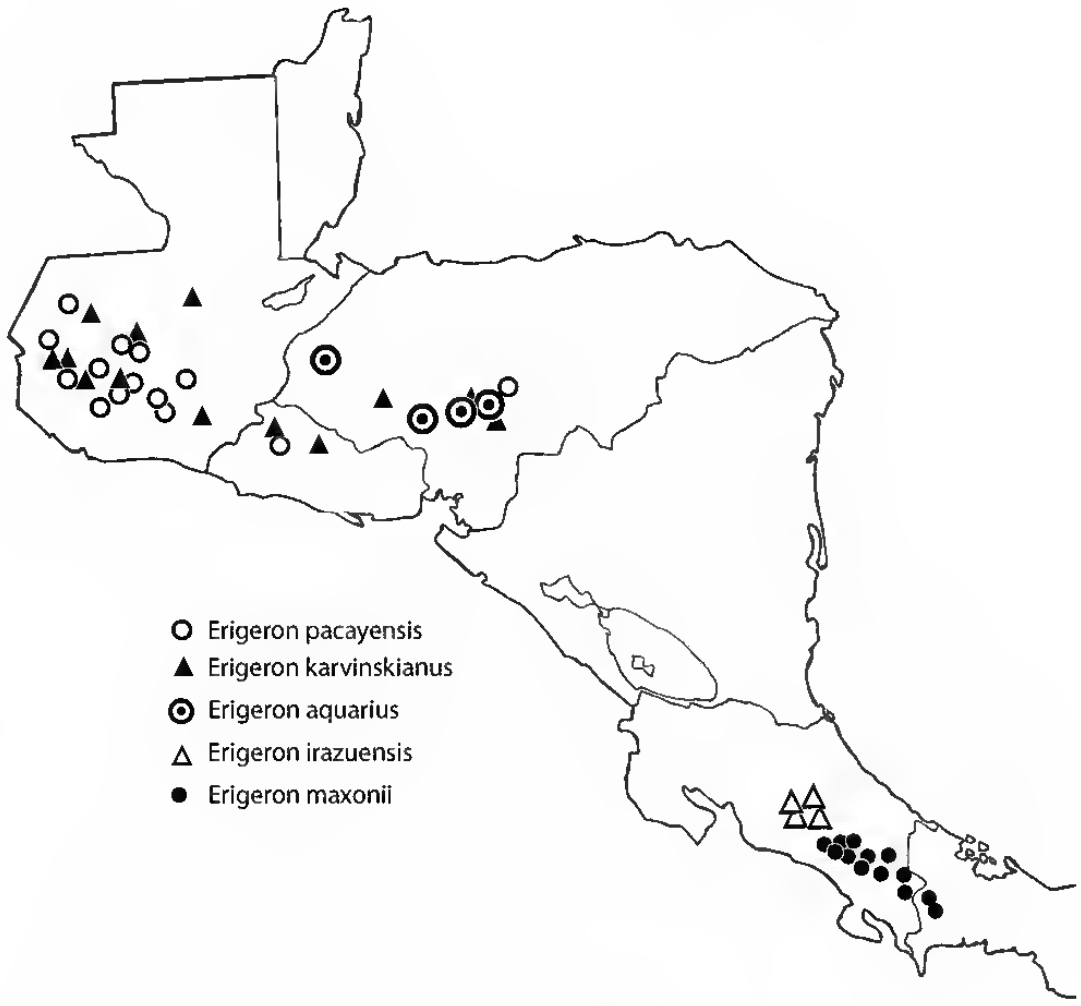

Figure 1. Distribution of species of the *Erigeron karvinskianus* group in Central America.

Figure 2. Holotype of *Erigeron irazuensis* (GH)

Dattilo, A.J. and D. Nestor. 2011. *Onosmodium bejariense* var. *subsetosum* (Boraginaceae): First report for Alabama. Phytoneuron 2011-37: 1–4.

ONOSMODIUM BEJARIENSE VAR. *SUBSETOSUM* (BORAGINACEAE): FIRST REPORT FOR ALABAMA

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ABSTRACT

The collections detailed here represent the first documented report of *Onosmodium bejariense* var. *subsetosum* for Alabama. Both populations were observed in open, transmission line rights-of-way on dry Cumberland Plateau Escarpment slopes in association with other rare plant taxa. Edaphic factors like bedrock geology, landscape position, and aspect, in conjunction with periodic clearing of woody vegetation, produce unique, open habitat along transmission line rights-of-way situated in this region.

KEY WORDS: *Onosmodium bejariense* var. *subsetosum*, Alabama Cumberland Plateau, transmission line, right-of-way

While performing botanical surveys of Tennessee Valley Authority transmission line rights-of-way in Madison County, Alabama, during 2010, we located two populations of *Onosmodium bejariense* DC. ex A. DC. var. *subsetosum* (Mack. & Bush) B.L. Turner (Figure 1). Both populations are in open rights-of-way along steep, south-facing Cumberland Plateau Escarpment slopes amongst limestone outcrops. Both are disjunct southeastward from their main geographical range and are the first documented occurrences of this taxon in Alabama (Kral et al. 2011; USDA, NRCS. 2011).

Vouchers. Alabama. Madison Co.: Transmission line right-of-way on dry, S-facing, Cumberland Plateau Escarpment slopes, in thin, limestone derived soils; from the intersection of Asbury road and HWY 431, proceed SE on Asbury Road about 0.75 miles to a transmission line right-of-way; several dozen individual plants present, observed in the right-of-way west of Asbury Road; 34.699780, -86.533540, 16 Jun 2010, *Dattilo 1009* with D. Nestor (TENN, AMNH); rocky transmission line right-of-way on dry, S-facing, Cumberland Plateau Escarpment slopes, in thin, limestone derived soils, 0.5 miles N of the confluence of the Paint Rock River and the Tennessee River, right-of-way just E of Clark Bluff; 34.485200, -86.468800; ca. 30 individual plants observed, 21 Oct 2010, *Nestor s.n.* (TENN, AMNH).

In the concept of Turner (1995) & Das (1965, as cited by Turner), populations of *Onosmodium bejariense* var. *subsetosum* are concentrated in Arkansas, Missouri, and eastern Oklahoma where it has been documented from at least 14, 32, and 2 counties, respectively (Fig. 2; USDA, NRCS 2011; Hoagland et al. 2004). *Onosmodium bejariense* var. *subsetosum* has also been previously reported roughly 250 miles east of its main range in Franklin and Rutherford County, Tennessee, where it is considered endangered by the Tennessee Natural Heritage Inventory Program.

The four distinct locations in Tennessee are reconciled from sight records reported to the Tennessee Natural Heritage Inventory Program and the Tennessee Valley Authority Heritage Program along with collections of taxon housed at TENN and VDB (Tennessee Valley Authority Natural Heritage Database 2011). The two Rutherford County locations, which are separated by about one mile, are located in the Inner Nashville Basin about 70 miles north of Huntsville, Alabama. These sites are found in open barrens-like habitat associated with limestone glade complexes characteristic of the region (Quarterman 1950). The two Franklin County locations are on relatively steep Cumberland Plateau Escarpment slopes with southerly exposure and limestone outcrops about 35 and 45 miles, respectively, from the Madison County collections.

Transmission line rights-of-way situated on Cumberland Plateau Escarpment slopes with southern exposure in the vicinity of Huntsville, Alabama, frequently support populations of state and globally rare species. Previously undocumented occurrences of *Blephilia submuda*, *Cotinus obovatus*, *Desmodium ochroleucum*, and *Silphium brachiatum* were also observed in transmission line rights-of-way that support *Onosmodium bejariense* var. *subsetosum*. Knowing where these rare taxa occur on Tennessee Valley Authority rights-of-way allows the agency to conduct transmission line maintenance without adversely impacting the plants. Periodic clearing of vegetation along transmission line rights-of-way is necessary to maintain the reliability of the transmission system, but the disturbance, especially when combined with the xeric conditions inherent to steep south and west facing slopes over limestone bedrock, retards establishment and growth of woody species and favors herbaceous species that thrive in dry, open conditions.

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Figure 1. *Onosmodium bejariense* var. *subsetosum* in a transmission line right-of-way west of Asbury Road, Madison County, Alabama. a. Mid to lower stem, b. Inflorescence, c. Adaxial leaf surface, d. Leaves and stem.

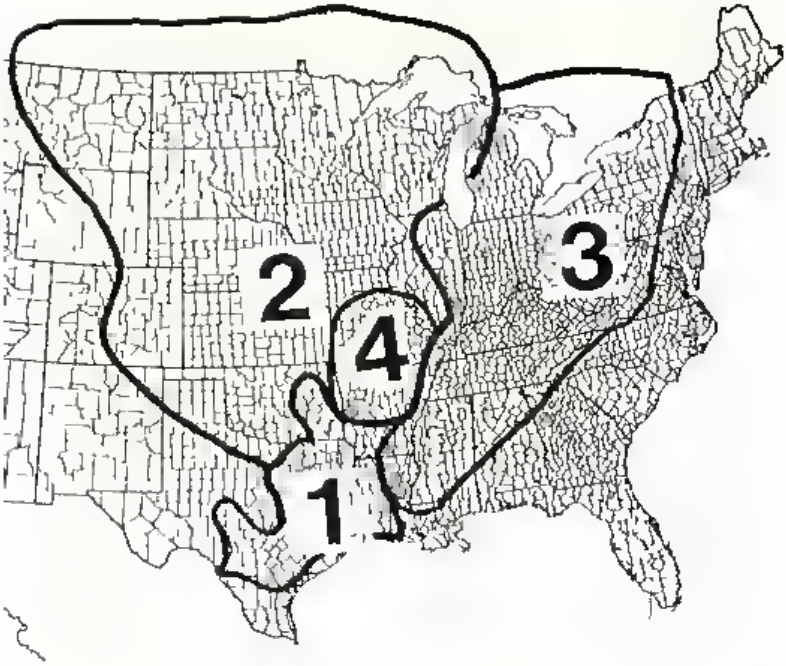

Figure 2 General distribution of the varieties of *Onosmodium bejariense* — (1) var *bejariense* (2) var *occidentale* (3) var *hispidissimum* (4) var *subsetosum* From Turner (1995) by permission

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HISTORY OF ARKANSAS PTERIDOPHYTE STUDIES WITH A NEW ANNOTATED CHECKLIST AND FLORISTIC ANALYSIS

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ABSTRACT

This is the fifteenth pteridophyte flora published for Arkansas. The state pteridophyte flora now lists 123 species documented (98 native and 25 naturalized) with 3053 county-level records or map dots. The pteridophytes are the most studied, best known, and most completely documented group of plants in Arkansas (Peck 2011). The history of the compilation of the 123 species is presented, along with reports of two species new to the state and other noteworthy collections, an annotated checklist, and qualitative analysis of phytogeographic trends of the Arkansas pterdiophyte flora. The extensive bibliography provides easy access to the literature documenting Arkansas floristic research on pteridophytes.

KEY WORDS: Arkansas pteridophyte flora, ferns, fern allies, checklist, native species, naturalized species, checklist, and phytogeography

Pteridophytes (ferns and related spore producing plants) in Arkansas were studied first by naturalists, then general botanists, and only recently by pteridologists. Floristic studies in Arkansas have continued unabated over the last 200 years. Among the earliest are the Louisiana Purchase explorations up the Red River by Thomas and Peter Custis in1806 (MacRoberts & MacRoberts 2004, 2005), up the Ouachita River to Hot Springs in 1804—1805 by William Dunbar and George Hunter (Berry 2003, Berry, Beasley, & Clements 2006), and up the Arkansas River in 1806—1807 by Zebulon Pike (Jackson 1966). They made observations and collections that were sent back to President Jefferson and thence on to Philadelphia for examination and classification by Pursh. Voucher specimens of plants mentioned in their notebooks or journals are hard to locate and if they still exist were taken in part to New York, London, and Paris. Many have not been accounted for (MacRoberts & MacRoberts 2004).

Published reports of ferns and fern allies (Peck & Peck 1988; Peck, Witsell, & Foti 2001) in Arkansas date back to 1819 with the travels and collections of Nuttall (1821, 1835), who listed 23 species (Table 1) of pteridophytes from the Arkansas Territory (Foster 1944). Nuttall's efforts were limited to the vicinity of the Arkansas River and its valley (Beidleman 1956), yet he reported a list that included 20% of the state's pteridophytes. The Arkansas specimens were taken back to Philadelphia for study (Fernald 1942;Vaulx 1946; Pennell 1950). Some were deposited there and others were sent to London and Paris. Eventually the pillwort (*Pilularia*) and the waterclover (*Marsilea*) collected in Arkansas were published as species new to science, and some of the vouchers are presently housed at the Missouri Botanical Garden in St. Louis (MO). George Engelmann visited Arkansas in 1935 and again in 1937. He collected specimens on his way from St. Louis to Little Rock and to Hot Springs on at least two trips (Jansma & Jansma 1991, 1992) with vouchers housed at MO, also.

Two species reported by Nuttall remain enigmatic in that no vouchers were located to document their occurrence: *Botrychium fumariodes* and *Asplenium ruta-muraria*. Meaning of the

old name *B. fumarioides* remains equivocal. Today it is associated with the fern *B. lunarioides*, which Nuttall was unlikely to have found along his route of travel. It was not reported as part of the Arkansas fern flora for another 150 years. It may have been an early name confusion that persisted until 1950s, wherein plants of *B. biternatum* were mistakenly called *B. lunarioides* by many southern taxonomists.

We know which fern was meant by the name *Asplenium ruta-muraria*. A voucher by Nuttall has not been seen, although Nuttall's report is cited subsequently by many authors from out of state. Interestingly, another Arkansas collector reported the species in Arkansas (Lesquereux 1860). Lesquereaux's collections of this fern were seen and reported by a third collector (Harvey 1881), who reported as having seen Lesquereux's vouchers at University of Arkansas – Fayetteville's herbarium (UARK). These vouchers have disappeared as well. Since the 1880s, no vouchers were seen, found, or made of this species in Arkansas. Nuttall established 21 species of pteridophytes as present in the Arkansas flora that can be confirmed today with his extant specimens as documentary vouchers (Table 1.)

Table 1. The 21 ferns and fern allies listed by Nuttall (1835) for Arkansas with Nuttall's names and current names, along with 2 enigmatic species.

Nuttall's Names	Modern Names	Notes
1. Adiantum pedatum	Adiantum pedatum	
2. Asplenium ebeneum	Asplenium platyneuron	
3. Asplenium rhizophyllum	Asplenium rhizophyllum	
4. Asplenium melanocaulon	Asplenium trichomanes	
5. Aspidium filix-femina	Athyrium asplenioides	
6. Azolla americana	Azolla microphylla	
7. Botrychium obliquum	Botrychium dissectum obliquum	
8. Cheilanthes vestita	Cheilanthes lanosa	
9. Asplenium angustifolium	Diplazium pycnocarpon	
10. Aspidium marginale	Dryopteris marginalis	
11. Equisetum hyemale	Equisetum hyemale	
12. Marsilea undetermined	Marsilea vestita	
13. Ophioglossum vulgatum	Ophioglossum pycnostichum	
14. Osmunda cinnamomea	Osmundastrum cinnamomeum	
15. Osmunda spectabilis	Osmunda regalis spectabilis	
16. Pilularia sp.	Pilularia americana	
17. Polypodium incanum	Pleopeltis polypodioides	
18. Polypodium vulgare	Polypodium virginianum	
19. Aspidium acrostichoides	Polystichum acrostichoides	
20. Pteris aquilina	Pteridium aquilinum pseudocaudatum	
21. Woodwardia virginica	Woodwardia virginica	
Asplenium ruta-muraria	Asplenium ruta-muraria	[no voucher; excluded]
Botrychium fumarioides	Botrychium sp.	[no voucher; excluded]

The second botanist to provide a list of the ferns in Arkansas was the geologist and botanist Leo Lesquereux (1860), who stayed three months in Arkansas during a field survey, including a trip to Hot Springs, allowing him to collect additional rock-preferring species. Lesquereux (1860) listed

36 taxa, including seven for which either he did not voucher, the voucher was lost, or he felt that they must be in Arkansas, somewhere, even if he had not yet seen them in the state. Three taxa were noted as "should be here but not seen:" *Botrychium virginianum, Onoclea sensibilis,* and *Woodsia obtusa.*

Lesquereux reported *Asplenium ruta-muraria,* but no voucher is known today nor has the species been seen anywhere in the state in the 1900s. If it did occur here and was collected, the voucher noted by Harvey (1881) no longer could be found at the University herbarium at Fayetteville by the 1920s. Further enigmatic are two additional taxa reported by Lesquereux: *Dryopteris cristatum* and *Dryopteris carthusiana.* The former was reported from swamps in the southeastern part of the state. No voucher is known. This may have been *Dryopteris ludoviciana* or *Dryopteris celsa* or some other misidentified fern. At this time, the southern *Dryopteris* were not well known, and several species and their hybrids in the Gulf Coast states were mistakenly called *D. cristata* in Arkansas, Louisiana, and Texas. The latter species, *D. carthusiana,* is now known in Arkansas but not from areas visited by Lesquereux or Nuttall. At a latter date Harvey (1881) claimed to have seen a voucher for this species collected near Pine Bluff by G.E. Lytle, but these were exchange specimens that Lytle collected at Pine Bluff, New York. Likewise, Lesquereux (1860) reported *Selaginella rupestris* for Arkansas. Based on seeing Lesquereux's vouchers at UARK (University of Arkansas at Fayetteville), Harvey (1881) listed this spikemoss for Arkansas. Likewise Coville (Branner & Coville 1891) reported it, but all vouchers of these three species were lost from UARK by the 1920s. Again, without proper specimen records, there is no way to resolve these enigmas. Lesquereux (1860) added eight species to the 21 by Nuttall to form a total of 29 species documented with vouchers (Table 2).

Table 2. The eight vouchered ferns and fern allies Lesquereux (1860) added to those vouchered by Nuttall, along with seven enigmatic species.

	Lesquereux's Names	Modern Names	Notes
22.	Adiantum capillus-veneris	Adiantum capillus-veneris	
23.	Asplenium pinnatifidum	Asplenium pinnatifidum	
24.	Cheilanthes alabamensis	Cheilanthes alabamensis	
25.	Cheilanthes tomentosa	Cheilanthes tomentosa	
26.	Cystopteris fragilis	Cystopteris protrusa	
27.	Allosorus atropurpureus	Pellaea atropurpurea	
28.	Selaginella apus	Selaginella apoda	
29.	Aspidium thelypteris	Thelypteris palustris	
	Selaginella rupestris	Selaginella rupestris	[no voucher]
	Aspidium cristata	Dryopteris cristata	[out of state, excluded]
	Aspidium spinulosum	Dryopteris carthusiana	[no voucher]
	Asplenium ruta-muraria	Asplenium ruta-muraria	[no voucher; excluded]
	Botrychium virginianum	Botrychium virginianum	[no voucher]
	Onoclea sensibilis	Onoclea sensibilis	[no voucher]
	Woodsia obtusa	Woodsia obtusa	[no voucher]

Harvey (1881), the first plant taxonomist at the newly established (1872) land grant university at Fayetteville, started herbarium UARK and compiled and published the third list of Arkansas ferns. He annotated his list of 40 ferns (no fern allies) with notes on the ranges and habitats in Arkansas, with particular emphasis on northwestern Arkansas. Some, but not many, of Harvey's vouchers still exist today at UARK. Harvey (1881) added eleven species to the 29 pteridophytes

previously reported for Arkansas by Nuttall and Lesquereaux. Four species of enigmatic status were also reported: *Asplenum ruta-muraria*, *Aspidium cristatum*, *Aspidium spinulosum*, and *Botrychium ternatum* var. *lunarioides*. Harvey stated that he had Lesquereux's specimens of *Asplenum ruta-muraria* but without comment on where they were collected. Those specimens were lost by the 1920s.

According to Harvey (1881), the specimens vouchering *Aspidium cristatum* (*Dryopteris cristata*) were collected from near Pine Bluff by G.E. Lytle. Again, they have not been seen at least since the 1920s and no replacement collections from the vicinity of Pine Bluff in Jefferson County, Arkansas, or anywhere else in the state have been made or found since then. There are, however, specimens of *D. cristata* by Lytle received in exchange by Harvey from Pine Bluff, New York, still kept in "out-of-state" folders at UARK. These specimens may have been mistakenly reported as from Arkansas. The vouchers for *Aspidium spinulosum* [*Dryopteris carthusiana*] if they existed or were correctly identified, were lost by the 1920s. Lastly, while no vouchers exist to support the report of *Botrychium ternatum* var. *lunarioides*, this reference is significant. The earlier enigmatic report of *Botrychium fumarioides* by Nuttall (1935) could have referred to the southern grape fern *Botrychium biternatum*, not the much more northerly *Botrychium lunaria* nor the as of yet undiscovered and unnamed *Botrychium lunarioides*. The only other possible grape fern that Nuttall should have collected was *Botrychium virginianum*, but this was also explicitly listed by Harvey (1881) as new to the state. Again, without vouchers the identity of this grape fern remains enigmatic. Adding Harvey's eleven species new to Arkansas to the 29 of previous lists resulted in a new total of 40 pteridophytes known and vouchered from Arkansas (Table 4).

Table 4. Eleven ferns reported as new to Arkansas and vouchered by Harvey (1881) with four enigmatic species.

Harvey's Names	Modern Names	Notes
30. Notholeana dealbata	Argyrochosma dealbata	
31. Asplenium bradleyi	Asplenium bradleyi	
32. Asplenium parvulum	Asplenium resiliens	
33. Botrychium virginianum	Botrychium virginianum	
34. Cheilanthes lanuginosa	Cheilanthes feeii	
35. Cystopteris bulbifera	Cystopteris bulbifera	
36. Phegopteris hexagonoptera	Phegopteris hexagonoptera	
37. Onoclea sensibilis	Onoclea sensibilis	
38. Aspidium noveboracense	Parathelypteris noveboracense	
39. Woodsia obtusa	Woodsia obtusa obtusa	
40. Woodwardia angustifolia	Woodwardia areolata	
Asplenium ruta-muraria	Asplenium ruta-muraria	[no voucher; excluded]
Aspidium cristatum	Dryopteris cristata	[no voucher; excluded]
Aspidium spinulosum	Dryopteris carthusiana	[no voucher]
Botrychium ternatum var. lunarioides	Botrychium biternatum	[no voucher]

George Davenport (1883) prepared a literature-based enumeration of the 155 kinds of ferns known from all states in the USA at that time. His account included a list of the states and the number of each species known or reported from that state. He reported 41 species for Arkansas,

following closely the list prepared by Harvey (1881).

In the fourth list of Arkansas plants, Branner and Coville (1891) included 45 species of ferns and fern allies. Although working mainly in the Little Rock area, botanist Coville also made a trip to Independence County (vicinity of Batesville) and Stone County. He constructed the list for the state geologist, Branner. The list included all species, vouchered and enigmatic, reported by Nuttall, Lesquereaux, and Harvey, but as the list was prepared in Little Rock, their voucher specimens at UARK were not consulted. Branner and Coville (1891) mistakenly reported *Cheilanthes eatoni* from near Little Rock based on a misidentified specimen of *Cheilanthes tomentosa*. Thus they restated the known state flora and perpetuated and added errors (Table 4.) Thus, the known and vouchered state pteridophyte flora remained at 40.

Table 4. Four enigmatic ferns and fern allies were reported as new to Arkansas by Branner and Coville (1891).

Coville's Names	Modern Names	Notes
Asplenium ruta-muraria	Asplenium ruta-muraria	[no voucher; excluded]
Aspidium cristatum	Dryopteris cristata	[out of state; excluded]
Aspidium spinulosum	Dryopteris carthusiana	[no voucher]
Cheilanthes eatonii	Cheilanthes tomentosa	[specimen misidentified]

By today's standards, the four lists published in the 1800s were poorly documented. Voucher specimens were not specifically cited. Collection localities were vague or not provided. The original herbarium of deposit was not stated. Collections often were broken and sold in parts. Many Harvey specimens now exist at MO and some have been exchanged or given as gifts to other herbaria.

The UARK herbarium languished until the 1920s when it was exhumed by J.T. Buchholz. Buchholz reorganized the collection, compared what had been reported with what was vouchered, and started to document the state flora with county-level collections rather than a simple list of species. Buchholz visited the major research herbaria in St. Louis (MO), Chicago (F), Boston (GH), New York City (NY), Philadelphia (PH), and Washington, DC (US) to inspect their Arkansas specimens. In turn, these grand eastern institutions, such as the Arnold Arboretum of Harvard University, sent professional field collectors such as Ernest J. Palmer in the 1910s–1930s to augment mid-South and Arkansas collections in national collections. This action was continued as a Civilian Conservation Corps (CCC) project in the 1930s by professional field collectors supervised by professional botanists such as George M. Merrill, who collected extensively in the Little Rock area.

Buchholz (1924) revised the lists of Harvey and Branner and Coville and attempted to locate all herbarium vouchers for prior reports. He arrived at 46 species and 3 varieties of pteridophytes in Arkansas. Based on his list and voucher specimens, Buchholz (1924) added 4 species to the 40 mentioned so far. He noted that the Nuttall collection of *Pilularia americana* became part of the personal herbarium of Elias Durand and was purchased by MO, where Buchholz inspected it. Another Nuttall specimen was found at NY and was annotated to be correctly named as *Marsilea vestita* rather than as *Marsilea uncinata*. He found a voucher of *Ophioglossum vulgatum* by Nuttall (1835) and used it to demonstrate that a Harvey collection was of a species new to Arkansas, *O. engelmannii*.

Additional collections of species new to Arkansas were reported by E.J. Palmer (1932). He reported *Pellaea glabella* as new to Arkansas — collected by D. Demaree at Belle Vista, a new summer resort northwest of Bentonville. He added as new to the flora *Isoetes melanopoda* collected from Conway by H.E. Wheeler and from Fayetteville, along with *Isoetes butleri* collected from Little Rock by R.M. Harper and H.E. Wheeler. More importantly, Buchholz (1924) noted the absence of vouchers for seven species: *Dryopteris cristata, Dryopteris spinulosa* [carthusiana], *Asplenium montanum, Matteuccia struthiopteris, Cheilanthes eatonii, Marsilea uncinata,* and *Selaginella rupestris*. *Asplenium montanum* and *Matteuccia struthiopteris* were erroneously reported from Arkansas in a fern manual by J.K. Small and in Gray's Manual, respectively. With this report, the pteridophyte flora of Arkansas stood at 44 species (Table 5).

Table 5. The four species added to the Arkansas pteridophyte flora by Buchholz (1924), and the six species specifically deleted as they lacked vouchers.

Buchholz's Names	Modern Names	Notes
41. Ophioglossum engelmannii	Ophioglossum engelmannii	
42. Pellaea glabella	Pellaea glabella	
43. Isoetes melanopoda	Isoetes melanopoda	
44. Isoetes butleri	Isoetes butleri	
Dryopteris spinulosa	Dryopteris carthusiana	[no voucher]
Dryopteris cristata	Dryopteris cristata	[out of state; excluded]
Matteuccia struthiopteris	Matteuccia struthiopteris	[no voucher; false report]
Cheilanthes eatonii	Cheilanthes tomentosa	[misidentified specimen]
Marsilea uncinata	Marsilea vestita	[misidentified specimen]
Selaginella rupestris	Selaginella rupesris	[no voucher]

Buchholz's study was immediately followed by Palmer's (1924) report of two species he found new to the state, which occurred widely in eastern North America but were disjunct in their occurrence at the top of Magazine Mountain, Logan County, Arkansas: *Dennstaedtia punctilobula* and *Woodsia scopulina*. These additions were incorporated in a supplemental list of plants new to Arkansas by Buchholz and Palmer (1926). This list was the first Arkansas flora report that referred to specific voucher specimens by collector, collection number, and herbarium of deposit. They commented on 15 species, reported five as new to Arkansas, and noted that there were 51 pteridophytes in the state flora. They were the first to note the second variety of bracken fern in Arkansas was *Pteridium aquilinum* var. *latiusculum*. They also reported *Equisetum prealtum* and *E. intermedium* based on identifications of *Equisetum* monographer J.H. Schaffner. The former is the species *E. hyemale* var. *affine*, found across the USA, while the latter is one of the names given to *E. ×ferrissii* before its hybrid biology was settled. Of note, Dwight Moore's recent collection of *Dryopteris spinulosa* [*carthusiana*] at Magazine Mountain re-instituted this species in the flora, but prior vouchers were not located. With this report, the vouchered pteridophyte flora of Arkansas now stood at 49 (Table 6).

Table 6. Five pteridophytes reported as new to Arkansas by Buchholz and Palmer (1926) — or once enigmatic but now vouchered.

Buchholz's Names	Modern Names	Notes
45. Botrychium dissectum var. dissectum	Botrychium dissectum var. dissectum	
46. Dryopteris spinulosa	Dryopteris carthusiana	[new specimen]
47. Dennstaedtia punctilobula	Dennstaedtia punctilobula	
48. Equisetum intermedium	Equisetum ×ferrissii	
49. Woodsia scopulina	Woodsia scopulina	

Scully (1937, 1939) produced two papers describing 18 and then 26 ferns and fern allies found in and around Hot Springs National Park. He reported the presence of the more northern lady fern known as *Athyrium filix-femina* var. *angustum*, common across northeastern North America, based on a specimen he had sent to J.K. Small for annotation. No voucher has been found. All other Arkansas material at that time was identified as var. *asplenioides*, which is common across southeastern North America. Interestingly, Scully did not notice the Spider Brake Fern, which was found there by Chandler (1941) as a recent escape now naturalized. Chandler was looking for *Cheilanthes alabamense*, which he could not find until aided by Scully. Thus, Scully and Chandler could not locate *Pteris multifida* and *Cheilanthes alabamensis* without help, whereas they are both quite common in the park today.

At the end of the 1930s, Dwight Moore (1940) published a brief note on whether *Selaginella rupestris* was part of the flora and properly vouchered. Buchholz (1924) determined that there were no vouchers to support its listing by earlier Arkansas botanists. Based on his study, Moore indicated that the first vouchered material was collected by Delzie Demaree in 1927 from Izard County and in five additional counties since then. None of these were visited by Lesquereux (1860), who had suggested that the species occurred in Arkansas.

In a new attempt to summarize past efforts with more field status notes, Dwight Moore (1940) provided an annotated checklist to 67 ferns and fern allies. The list was proper for its time, when there were many superfluous varietal names and much confusion as to the correct name for a species in the genera *Equisetum* and *Botrychium*. For example, the plant known as the modern hybrid *E. ×ferrissii* was called *E. hyemale* var. *intermedium* and *E. laevigatum* by various workers, including J.N. Schaffner who mistypified North American material and remained confused until corrected by Richard Hauke in the 1960s. Moore (1941) reported both forms of *Botrychium dissectum*; the other two leathery grape ferns he reported most probably referred to *B. biternatum* and *B. multifidum*. The latter was erroneously based on a single problematic frond which was clearly not the more northerly species but another frond of *B. biternatum*. Again, the true *B. lunarioides* was still unknown from Arkansas.

Moore (1940) reported six species as new to Arkansas (including *Selaginella rupestris*) and nine enigmatic species. After a ten year search, Moore located *Osmunda claytoniana* in 1936 near where Buchholz had seen it picked and displayed in a vase in Pope County. Moore reported his discovery of *Equisetum arvense* in 1935 in Washington County. He reported that Flora A. Haas of Arkansas State Teachers College (now University of Central Arkansas) discovered *Lycopodium appressa* in 1931 from Saline County. Significantly, Moore (1940) mistakenly noted that the rare

Dennstaedtia punctilobula had been reported from Pine Bluff. Because that specimen still exists, it is possible to correct the literature. The fern was collected and mistakenly named as *Dicksonia punctilobula*, an earlier name no longer used, but the fern actually was a specimen of the common *Phegopteris hexagonoptera*. Without that specimen there would have been no way to eliminate this error from the literature. Although reported earlier by Harvey (1881), no vouchers could be found to substantiate the listing of *Cheilanthes feei* in the Arkansas flora until E.J. Palmer recollected or first collected it in 1927. Although not involved with its discovery, Moore (1940) listed the mysterious *Dryopteris* called the "Palmer Fern" found by Demaree and Palmer near Shirley, Arkansas. In 1940, no one knew where the fern was in the state or could find it. It remained "lost" until rediscovered by W.C. Taylor at the same location at Shirley (Wagner & Taylor 1976; Taylor 1982). Lastly, Moore (1940) reported *Asplenium ×ebenoides* as new to the state based on a personal collection from Crawford County in 1937, but no voucher of this find has been found since then. Thus, with Moore's efforts, the reported and vouchered Arkansas pteridophyte flora based on modern species concepts then consisted of 55 kinds (Table 7).

Table 7. Six species were added by Moore (1940) to the Arkansas pteridophyte flora, along eight excluded species.

Moore's Names	Modern Names	Notes
50. Dryopteris clintoniana var. australis	Dryopteris ×leedsii	"Palmer's Fern"
51. Equisetum arvense	Equisetum arvense	
52. Lycopodium appressum	Lycopodiella appressa	
53. Osmunda claytoniana	Osmunda claytoniana	
54. Pteridium aquilinum var. latiusculum	Pteridium aquilinum subsp. latiusculum	
55. Selaginella rupestris	Selaginella rupestris	[reinstated; new voucher]
Asplenium ×ebenoides	Asplenium ×ebenoides	[no voucher; excluded]
Asplenium cryptolepis	Asplenium ruta-muraria	[no voucher; excluded]
Athyrium angustum	Athyrium asplenioides	[misidentified; excluded]
Botrychium dissectum var. tenuifolium	Botrychium biternatum	[no voucher, excluded]
Botrychium multifidum var. silaifolium	Botrychium sp.	[no voucher; excluded]
Cheilanthes feeii	Cheilanthes feeii	[reinstated; new voucher]
Cystopteris fragilis fragilis	Cystopteris tennesseensis	[misidentified; excluded]
Dryopteris cristata	Dryopteris cristata	[no voucher; excluded]
Equisetum laevigatum	Equisetum ×ferrissii	[misidentified]

Moore (1941) also published a paper entitled "Some Noteworthy Fern Communities of Arkansas," which included lists of species found in five different localities within the Interior Highlands. First, he updated Scully's lists of the ferns of the Hot Springs area in Garland County by adding five species for a total of 31 species. Second, he reported 27 species from Magazine Mountain in Logan County. Third, he reported 15 species in a circle with a radius of 50 feet at Sand Gap (Pelsor) in Pope County. Fourth, he reported 14 species above on Martin's Bluff in Benton County and 20 species below. Fifth, from Savoy in Washington County he reported nine species on a north-facing slope and eleven species on a south-facing slope. He concluded with a list of 18 rare Arkansas

pteridophytes and their general locations.

Delzie Demaree, whose contributions to Arkansas botany spanned five decades, almost single-handedly vouchered most state county records known at that time for the vascular flora, adding many tens of thousands of specimens to Arkansas and out-of-state herbaria. Most collections were written using the local post office as a reference point, as there were few other places of permanence. "Doc" was of the opinion that if you were any good at all in the field, you could find it on your own, given the nearest post office. He spent considerable time in the 1920s and 1930s with Buchholz and Palmer documenting the Arkansas flora, species by species, county by county. He did not publish much; he let his collections speak for themselves (Taylor 1982).

Demaree (1943a) published a brief note on Arkansas ferns that added *Cystopteris fragilis* var. *simulans* to the state flora. Only four years earlier John Shaver (1939) elevated this variety to species rank with the name of *Cystopteris tennesseensis*. Demaree collected this plant in Stone Co. in 1942. Earlier specimens by Demaree of this taxa from Magnet Cove, Hot Spring Co., were mistakenly identified as *Cystopteris fragilis* var. *fragilis* by Moore (1940). Demaree (1943a) also noted his collections of five other rare Arkansas ferns not included in Moore (1940).

Demaree (1943b) compiled a summary list of all plants ever reported from Arkansas in a personal, private publication named Taxodium, or "Catalogue of Vascular Plants of Arkansas." He listed 70 taxa of ferns in 30 genera, including all misnamed and enigmatic collections in the inventory, and noted the clarification of the correct species name of *Cystopteris* in Arkansas (Table 8). Demaree continued to collect and send specimens to specialists and by 1974 Demaree's collection numbers exceeded 74,000. He collected plants for another 12 years beyond that without collection numbers, so his life total was probably near 80,000 numbers, and most of those with 5–10 duplicates sent nationwide. No other Arkansas botanist then or since has come close to this level of dedication to collecting and documenting the Arkansas flora. He did this without maps, without owning or driving a car while botanizing, and even in summer he ran his internal home floor furnace full blast to dry multiple presses indoors, with the windows closed to save energy! It was a distinct honor and privilege to know "Doc".

Since the early 1940s, modern research methods in plant taxonomy and systematics led to a new effort to study plants in their native habitats and with quantitative methods. These led to many revised species concepts, nomenclatural changes, and monographs on taxonomically difficult genera. With improved roads and better tires, field work improved in Arkansas, resulting in nearly a dozen additional pteridophytes reported as new to the state from 1940 through 1976, including those reported by Chandler (1941), Demaree (1943a), Moore (1947, 1950, 1951, 1957, and 1958), Moore and Hartsoe (1955), Wagner (1962), Clark (1962), Bowers and Redfearn (1967), Farrar and Redfearn (1968), Tucker (1971), and Wagner and Taylor (1976) and summarized in Table 8.

Moore (1947) reported many critical discoveries to rare and enigmatic species and added two species to the Arkansas pteridophyte flora (Table 8). Moore's collection of *Pilularia americana* in 1942 was its second collection in Arkansas — the first being in 1819 by Nuttall — after an absence of 123 years! It was discovered in a lake that was only five years old. Moore (1947) found *Athyrium thelypterioides* in 1942 on Magazine Mountain, Logan Co, to provide the first voucher for this species in Arkansas. Moore (1947) reported another collection of *Marsilea vestita* by Demaree from Arkansas Co. and the second state collection of *Equisetum arvense* by Demaree at St. Francis Co. and the third by Moore from Stone Co. Moore (1947) also reported new collections to voucher old reports of *Anchistea virginica* [*Woodwardia virginica*] and *Asplenum pinnatifidum,* wherein their old vouchers were lost or never collected.

Lastly, while confirming this last spleenwort at Pea Ridge National Military Cemetery, Moore (1947) encountered in 1943 an unusual fern that appeared to be a hybrid. After consultation with national fern experts such as E.T. Wherry, Moore (1947) reported it as *Asplenium ×stotleri*. Wherry told W.H. Wagner about this odd fern. Wagner was unraveling the mysteries of the reticulate relationships of Appalachian Aspleniums and eventually annotated this plant in 1953 as *Asplenium ×kentuckiense*, the central triploid hybrid composed of three different species genomes, being the last major problem to be resolved in this complex (Wagner 1958).

On 12 April 1945, Dwight Moore (1950) discovered as new to Arkansas a minute fern which was identified for him as *Ophioglossum crotalophoroides* by C.F. Reed in March 1946 at St. Louis at a national meeting of the American Fern Society. Moore (1951) reported five recollections of rare ferns and other plants in Arkansas. Jewel Moore and Hartsoe (1955) reported *O. crotalophoroides* as a second state record from Faulkner Co. D. Moore (1957) reported it in five more counties and then (1958) in three more counties, for a total of 10 counties.

Demaree made the first state collection of *Trichomanes boschianum* on 20 August 1961 from Cleburne Co., in a locality disjunct by more than 200 + miles to the west of the nearest populations in Illinois and Alabama (Wagner 1962). Eight months later, in February 1962, Maxine Clark discovered this fern in Madison Co, 100 miles to the west of Demaree's locality (Clark 1962).

Frank Bowers and Paul Redfearn (1967) reported the second clubmoss species known from Arkansas when they reported *Lycopodium lucidulum* as present in Franklin and Madison counties. They were searching for mosses as part of their survey of the mosses of the Interior Highlands.

Don Farrar and Paul Redfearn (1968) reported as new to Arkansas the minute filmy fern *Trichomanes petersii* which they discovered in Pope Co, again while searching for moss records. While they did not know this, this was the same locality where Dwight Moore had discovered *Osmunda claytoniana* some 32 years earlier. This population was also disjunct from populations in Illinois and Alabama.

Wagner and Wagner (1969) included a discussion on *Asplenium bradleyi* with unusual leaf morphology found at Blanchard Springs found by D.R. Farrar. They suggested that some of the plants might be the first report of the sterile diploid progenitor of the fertile tetraploid that is common in Arkansas and widespread in eastern North America. Subsequent work proved that these plants were unusual but tetraploids as well.

Gary Tucker (1971) discovered a second spikemoss for Arkansas on 16 September 1967 when he discovered *Selaginella arenicola* subsp. *riddellii* at Pussy Point on Norristown Mountain in Pope Co. and at a sand barren near Chidester in Ouachita Co. on 19 April 1969. Prior to this the species was only known from Louisiana, Oklahoma, and Texas.

W.C. Taylor and Delzie Demaree relocated the mysterious Palmer *Dryopteris* in August 1974 at Shirley (Wagner & Taylor 1976). It had been visited for eight years after its discovery in 1928 by Palmer and Demaree but after a drought and cattle grazing was not seen since 1936 and its location was "lost." In 1964 Paul Redfearn and W.H. Wagner attempted but failed to relocate this fern, which had been conflictingly named 13 different things by fern experts in the interim (Peck 2000). After its rediscovery, Wagner confirmed that it was *Dryopteris ×leedsii*, a very rare fern hybrid (Wagner & Taylor 1976; Taylor 1982).

With so many species reported as new to Arkansas and with a need to reexamine all herbarium specimens in the light of a new nomenclature, a serious reappraisal of the Arkansas

pteridophytes was needed. W.C. Taylor undertook this project as part of his doctoral program at Southern Illinois University under Dr. Robert Mohlenbrock. Taylor inspected and annotated all herbarium specimens within Arkansas and in many national institutions in the USA. He surveyed old collection locations, collected new vouchers, and attempted to document all old records of Arkansas pteridophytes (Wagner & Taylor 1976). Dr. Demaree showed Taylor how to "scratch gravel" across the rugged Arkansas terrain (Taylor 1982, 1984). Several updates were prepared to summarize studies on variation in quillworts and spleenworts (Taylor et al. 1975, 1976).

Taylor's dissertation (1976) provided a new standard for floristic knowledge of 73 Arkansas pteridophytes, clarified many enigmatic species, and included eight species new to Arkansas reported previously since the list by Moore (1940) as well as three taxa new to Arkansas but previously unreported (Table 8). Taylor (1976) reinstated *Asplenium ×ebenoides* based on a collection by David Johnson, clarified the confused grape fern situation by adding *Botrychium biternatum*, and noted the presence of *Dryopteris celsa* in Arkansas wherein it had been collected in 1924 but overlooked in an out-of-state herbarium. Taylor (1976) also documented his work at the county level by recording vouchers to 1321 county records and displaying them on county dot-maps. These eleven pteridophytes, added to the previous total, brought the known state pteridophyte flora to a total of 65 species plus hybrids (Table 8).

Table 8. Since Moore (1940), eleven additions were made to the Arkansas pteridophyte flora in the 1940s through early 1970s. These were summarized in Taylor (1976).

Taylor's Names	Modern Names	First Report
56. Pteris multifida	Pteris multifida	Chandler (1941)
57. Cystopteris tennesseensis	Cystopteris tennesseensis	Demaree (1943a)
58. Asplenium ×kentuckiense	Asplenium ×kentuckiense	Moore (1947)
59. Athyrium thelypterioides	Deparia acrostichoides	Moore (1947)
60. Ophioglossum crotalaphoroides	O. crotalaphoroides	Moore (1950)
61. Trichomanes boschianum	Trichomanes boschianum	Clark (1962); Wagner (1962)
62. Lycopodium lucidulum	Huperzia lucidula	Bowers & Redfearn (1967)
63. Trichomanes petersii	Trichomanes petersii	Farrar & Redfearn (1968)
64. Selaginella arenicola	Selaginella corallina	Tucker (1971)
65. Botrychium biternatum	Botrychium biternatum	Taylor (1976
66. Dryopteris celsa	Dryopteris celsa	Taylor (1976)
Marsilea quadrifolia	Marsilea vestita	[misidentified; excluded]

Smith (1978) prepared the first Arkansas vascular plant flora with county-level dot maps for each species. He essentially based the pteridophyte treatment on Taylor (1976), but he only listed 70 species with 1288 county records. The work of Key (1975) on the pteridophytes of the Interior Highlands should also be mentioned as it described many of the pteridophytes occurring in Arkansas, but it lacked keys and dot maps essential to evaluate the likelihood of species in southern Missouri that might yet be found in the northern part of Arkansas.

While Taylor worked to publish a technical account from his dissertation, additional species new to Arkansas were discovered and reported. William Buck (1977) separated a northern variation

of *Selaginella apoda* based on different spore morphology and leaf form, and elevated it to species rank, naming it the Eclipsed Spikemoss, *S. eclipes*, and reported that it occurred in Arkansas. R. Dale Thomas (1978) reported three species that frequented rural cemeteries as being new to Arkansas: *Botrychium lunarioides*, *Ophioglossum nudicaule,* and *O. petiolatum.* W. C. Taylor and D. Johnson (1979) reported two species as new to Arkansas: *Thelypteris normalis* and *Thelypteris torresiana.* Johnson also located one plant of *Asplentum ×ebenoides* in Pope Co. in 1979. Two very old specimens of *Cheilanthes eatonii* from localities in northern Arkansas were discovered in herbaria collections, adding this species to the flora. These additions were added to the published version of Taylor's doctoral dissertation (Taylor & Demaree 1979). This modern account reported 78 taxa, supported by specimen vouchers (collector name, number, and herbarium of deposit) for 1335 county records mapped as county dots on species maps, adding eight species to the state flora, bringing the known and vouchered pteridophyte flora to 74 (Table 9).

Table 9. Eight ferns and fern allies were added to the Arkansas pteridophyte flora as summarized in Taylor and Demaree (1979).

Taylor's Names	Modern Names	First Report
67. Asplenium ×ebenoides	Asplenium ×ebenoides	Taylor & Demaree (1979)
68. Botrychium lunarioides	Botrychium lunarioides	Thomas (1978)
69. Cheilanthes eatonii	Cheilanthes eatonii	Taylor & Demaree (1979)
70. Ophioglossum nudicaule	Ophioglossum nudicaule	Thomas (1978)
71. Ophioglossum petiolatum	Ophioglossum petiolatum	Thomas (1978)
72. Selaginella eclipes	Selaginella eclipes	Buck (1977)
73. Thelypteris torressiana	Macrothelypteris torressiana	Taylor & Johnson (1979)
74. Thelypteris normalis	Thelypteris kunthii	Taylor & Johnson (1979)

After the dot maps of Taylor and Demaree (1979) were published, another fern new to the state (*Asplennum ×gravesii*) was located at Hot Springs, Garland Co. (Werth & Taylor 1980). J.H. Peck collected the horsetail *Equisetum laevigatum* in Crawford Co. as new to the state in 1981. Charles Meyer discovered *Lygodium japonicum* in Ashley Co. as a roadside weed in pine plantings in 1981. Jewel Moore (1982) prepared an identification manual to Arkansas pteridophytes for her students to use based on xerographic silhouettes. Summarizing all of this activity, Taylor (1984) provided a book-length manual with illustrations, descriptions, keys, voucher citations, and species dot maps for 81 pteridophytes (72 species, 5 hybrids, and 4 varieties) in 31 genera with 1356 county records. The fine line drawings by Paul W. Nelson inspired many to seek and identify ferns for the first time. This manual stimulated a resurgence of activity to locate and document Arkansas ferns. The Arkansas pteridophyte flora now contained 76 known and vouchered taxa (Table 10).

Table 10. Three additions to the Arkansas pteridophyte flora as presented in Taylor (1984).

Taylor's Names	Modern Names	First Report
75. Asplenium ×gravesii	Asplenium ×gravesii	Werth and Taylor (1980)
76. Equisetum laevigatum	Equisetum laevigatum	Taylor (1984)
77. Lygodium japonicum	Lygodium japonicum	Taylor (1984)

In the 1980s, Arkansas also underwent a resurgence in field botany activity to document its biodiversity. The result was an extraordinary burst in floristic activity on pteridophytes, which some had thought to be a settled issue. In 1981, Arkansas acquired its first resident pteridologist (J.H. Peck at University of Arkansas at Little Rock). He initiated a 30-year survey of fern abundance and distribution within Arkansas. Staff and contract botanists working for the Natural Heritage Commission, Ouachita National Forest, and Arkansas Field Office of The Nature Conservancy were directed to evaluated known old populations and to locate new populations and county or state records.

Pteridologists from out of state utilized Arkansas sample material to resolve phylogenetic and genetic problems. Using protein electrophoresis, Werth studied population variability of *Dryopteris* species and hybrids (Werth 1991) such as *D. carthusiana, D. marginalis,* and *D. celsa*. Werth, Evans, and Ware (1988) contrasted phenomena in the eastern USA with the situation in Arkansas in regard to *Dryopteris ×australis, D. celsa, and D. ludoviciana*. Li and Haufler (1984) studied isozyme diversity of the three species in *Osmunda* using Arkansas material compared to populations in the southern Appalachians and from more northerly locations. Our species differed less than plants that had migrated northward in the last 10,000 years. The results suggested that the basal species in the group was the cinnamon fern.

As a consequence of the activities by academics and contract botanists, one scouringrush (reported in Taylor 1984), two wood ferns, and seven clubmosses were added to the state flora (Orzell & Peck 1985; Peck et al. 1985a, 1985b, 1987; Peck & Peck 1988a, 1988b). Additionally, many studies were initiated to study the rare plants of Arkansas, including pteridophytes. Dan Marsh at Henderson State University and his students commenced studies on the abundance and distribution of Coastal Plain species of *Lycopodiella*, *Botrychium,* and *Ophioglossum.* Studies such as these led to additional reports on pteridophytes (Bates & Pittman 1993; Bray & Marsh 1993; Culwell 1994, Farrar 1985, 1990, 1992; Orzell & Bridges 1987; Peck 1985a, 1985b, 1986a, 1986b; Peck & Peck 1987, 1988b; Sundell 1986).

Summary documents were developed to compile, collate, and summarize these changes, updates, and numerous county records (Peck & Peck 1986, 1988a, 1988b; Peck et al. 1987a, 1987b). Peck and Peck (1986) added 297 county records to the distributions of 43 taxa. Nine species were added to the state flora for a total of 86 pteridophytes known and vouchered for Arkansas (Table 11).

Table 11. Nine additions to the Arkansas pteridophyte flora after Taylor (1984) as summarized by Peck and Peck (1986), Peck et al. (1987), and Peck and Peck (1988).

Reported Name	Modern Name	First Report
78. Lycopodium digitatum	Diphasiastrum digitatum	Peck & Peck (1988)
79. Dryopteris ludoviciana	Dryopteris ludoviciana	Peck et al. (1985b)
80. Dryopteris ×australis	Dryopteris ×australis	Orzell & Peck (1985)
81. Lycopodium alopecuroides	Lycopodiella alopecuroides	Peck & Peck (1986)
82. Lycopodium prostrata	Lycopodiella prostrata	Peck & Peck (1986)
83. Lycopodium ×bruceii	Lycopodiella ×bruceii	Peck & Peck (1986)
84. Lycopodium ×copelandii	Lycopodiella ×copelandii	Peck & Peck (1986)
85. L. alopecuroides × prostrata	L. alopecuroides × prostrata	Peck & Peck (1986)
86. Lycopodium caroliniana	Pseudolycopodiella caroliniana	Peck & Peck (1986)

To produce a second edition of his checklist and atlas of Arkansas vascular plants, Smith (1988) used Taylor (1984) and reports by Peck and other workers (see Table 11) to update and report a state pterdiophyte flora of 78 species and to provide dot maps with 1622 county records. No new taxa were added to the known list of Arkansas pteridophytes.

The pteridophyte floristic effort started in the 1980s continued apace in the 1990s. Field work yielded additional species new to Arkansas. Reports added a quillwort (Brown & Thomas 1992), a whiskfern (Bray et al., 1994; Peck et al. 1995; Thomas et al. 1999) and many county records. Material of *Woodsia scopulina* from Magazine Mountain was used in an electron microscope study to demonstrate the presence of vessels in that species, a condition that is thought to be rare in ferns (Schneider & Carlquist 1988).

Other national efforts to conduct systematic studies on problematic fern genera of North America led to revisions that affected the correct names of ferns in Arkansas. Revisions to the genus *Cystopteris* (Haufler & Windham 1991; Haufler et al. 1985; Haufler, et al. 1990) added three taxa to the Arkansas flora. Revision of the genus *Marsilea* (Johnson 1986, 1988) subsumed two historical species or varieties (*M. mucronata* and M. *uncinata*) into one encompassing species, *Marsilea vestita*. A revision of *Polypodium* (Haufler & Windham 1991) changed the generic name of one species in the Arkansas flora. The revision of genus *Woodsia* (Windham 1993) added a second variety to the typical *Woodsia obtusa*. These were brought together in 1993 with Volume 2 of Flora North America, which provided keys and detailed descriptions of all pteridophytes north of Mexico. Changes in generic nonmenclature significantly affected six genera in Arkansas: *Lycopodium, Athyrium, Lorinseria, Notholeana, Polypodium,* and *Thelypteris*. Other changes affected varieties or forms in *Asplennum, Marsilea, Thelypteris,* and *Woodsia*. Smith (1994) used this source to update the nomenclature in his keys to the vascular flora of Arkansas.

Four taxa were added to the Arkansas pteridophyte flora from generic revisions and two taxa were added from field collecting. Peck and Taylor reported these six additions in a new summary checklist of 92 pteridophytes provided with county dot maps with 2224 county records (Table 12).

Table 12. Four species and two hybrids native to the Arkansas were added to its pteridophyte flora as summarized in Peck and Taylor (1995).

Reported Name	Modern Name	First Report
87. Cystopteris tenuis	Cystopteris tenuis	Peck & Taylor (1995)
88. Cystopteris bulbifera × tennesseensis	C. bulbifera × tennesseensis	Peck & Taylor (1995)
89. Cystopteris protrusa × tennesseensis	C. protrusa × tennesseensis	Peck & Taylor (1995)
90. Isoetes engelmannii	I. engelmannii	Brown & Thomas (1992)
91. Psilotum nudum	Psilotum nudum	Bray et al. (1994)
92. Woodsia obtusa occidentalis	W. obtusa occidentalis	Windham (1993)

Over the last 15 years (1996–2011), field work has focused on species often overlooked or misidentified in herbaria as they were generally undercollected or poorly separated within herbaria. Special efforts were made for species that were known from adjacent states but not yet know in Arkansas. Species with very specific microhabitats within wetlands, cliff faces or sheltered rock houses, and disturbed barrow pits were studied intensively. Additionally, an emphasis was placed on documenting the naturalization potential of ferns cultivated in Arkansas, leading to the discovery of

many such escapes not previously suspected or documented. Special efforts were made to inspect parklands in the greater Little Rock vicinity and at Hot Springs in and around the grounds of Garvan Woodland Garden (Crank & Peck 2011).

Since 1995, 12 fern taxa (Table 13) have been added to the Arkansas flora as new and native (Peck 2011). The species new to Arkansas include a clubmoss (Bray 1996), a log fern species and hybrid (Peck, Witsell, and Hendrix 1999; Peck 2000), an aquatic mosquito fern (Peck 2003), and four spleenworts, a second pepperwort, and a second lady fern (Peck 2011). Of the reported Arkansas native ferns, one was deleted (*Azolla caroliniana*), being treated as a synonym of *Azolla mexicana* and now correctly known as *Azolla microphylla*. The separation of Arkansas *Azolla* material into two kinds of mosquito ferns was mainly the result of mis-interpreting smaller plants found floating and shaded that differed with larger plants found stranded on mudflats, in full sun, and with higher levels of nutrients in sediments than in open water. Thus differential growth altered one kind into two kinds. Two hybrids (*Huperzia ×bartleyi* and *Dryopteris ×neowherryi*) were erroneously attributed to the Arkansas flora and were excluded (Peck 2003).

Table 13. Eight species and two hybrids native and new to the pteridophyte flora of Arkansas were added after Peck and Taylor (1995) and summarized in Peck (2011).

Reported Name	Modern Name	First Report
93. Asplenium montanum	Asplenium montanum	Peck (2011)
94. Asplenium ruta-muraria	Asplenium ruta-muraria	Peck (2011)
95. Asplenium septentrianale	Asplenium septentrianale	Peck (2011)
96. Asplenium ×trudellii	Asplenium ×trudellii	Peck (2011)
97. Athyrium angustum	Athyrium angustum	Peck (2011)
98. Dryopteris goldiana	Dryopteris goldiana	Peck et al. (1999)
99. Dryopteris celsa × goldiana	D. celsa × goldiana	Peck et al. (1999)
100. Marsilea macropoda	Marsilea macropoda	Peck (2011)
101. Palhinhaea cernua	Palhinhaea cernua	Bray (1996)
102. Trichomanes intricatum	Trichomanes intricatum	Peck (2011)
Azolla caroliniana	Azolla microphylla	Peck (2003); subsumed
Dryopteris ×neowherryi	Dryopteris ×neowherryi	Peck (2003); misidentified
Huperzia ×bartleyi	Huperzia ×bartleyi	Peck (2003); misidentified

Since 1995, 20 fern taxa (Table 14) have been added as new and naturalized to the Arkansas fern flora (Peck 2011). These reports include two species of water spangles (Peck 1999, 2000; Peck & Serviss 2006), a Yankee Fern (Peck 2002), one log fern and one waterclover fern (Simpson, Crank, Witsell, and Peck 2008), two holly ferns (Peck 2003), an East Indian Holly Fern, Japanese Painted Lady Fern, a bramble fern, a rock fern, a third water clover, a second beech fern, and six spikemosses (Table 14). Two species (*Matteuccia struthiopteris* and *Thelypteris kunthii*) are native to the USA but not native in Arkansas, but as they were extensively cultivated around homesteads, they have spread, escaped, and naturalized into and across Arkansas (Peck 2011). Of the reported Arkansas naturalized ferns, one was deleted (*C. fortunei*), being without a known voucher (Peck 2011). By the end of that year, two populations were located in Chicot and Desha counties, so that *Cyrtomium fortunei* was reinstated into the Arkansas fern flora with this report. Another non-native fern cultivated in Arkansas has recently escaped and naturalized: *Polystichum setiferum* is now reported as an addition to the Arkansas fern flora with this report.

Table 14. Twenty-one naturalized species were added as new to the pteridophyte flora of Arkansas after Peck and Taylor (1995) and summarized in Peck (2011), plus two new additions based on the present report.

Reported Name	Modern Name	First Report
103. Arachniodes simplicior	Arachniodes simplicior	Peck (2011)
104. Athyrium niponicum'Pictum'	Athyrium niponicum 'Pictum'	Peck (2011)
105. Cyrtomium falcatum	Cyrtomium falcatum	Peck (2003)
106. Dryopteris erythrospora	Dryopteris erythrospora	Simpson et al. (2006)
107. Hypolepis tenuifolia	Hypolepis tenuifolia	Peck (2011)
108. Marsilea mutica	Marsilea mutica	Peck (2011)
109. Marsilea quadrifolia	Marsilea quadrifolia	Simpson et al. (2006)
110. Matteuccia struthiopteris	Matteuccia struthiopteris	Peck (2011)
111. Nephrolepis exaltata	Nephrolepis exaltata	Peck (2002)
112. Polystichum tsus-sinense	Polystichum tsus-simense	Peck (2011)
113. Phegopteris decursive-pinnata	P. decursive-pinnata	Peck (2011)
114. Salvinia minima	Salvinia minima	Peck (1999, 2000)
115. Salvinia molesta	Salvinia molesta	Peck (2011)
116. Selaginella braunii	Selaginella braunii	Peck (2011)
117. Selaginella kraussiana	Selaginella kraussiana	Peck (2011)
118. S. k. 'Aurea'	S. k. 'Aurea'	Peck (2011)
119. S. k. 'Brownii'	S. k. 'Brownii'	Peck (2011)
120. S. k. 'Goldtips'	S. k. 'Goldtips'	Peck (2011)
121. Selaginella uncinata	Selaginella uncinata	Peck (2011)
122. Cyrtomium fortunei	Cyrtomium fortunei	Peck (present report)
123. Polystichum setiferum	Polystichum setiferum	Peck (present report)

Recent New and Noteworthy Collections

Falcate Holly Fern – **Cyrtomium falcatum** (L.f.) C. Presl var. **falcatum** (Dryopteridaceae)—This native of Japan has continued to be widely planted in southern Arkansas as it is quite drought resistant (Hoshizaki & Moran 2001; Mickel 2003; Olsen 2007) . Peck (2011) reported 3 counties vouchered with naturalized specimens. Nine more counties are reported here.

Voucher specimens: **ARKANSAS: Calhoun Co.**: *Peck 2010474* (BRIT). **Clark Co.**: *Peck 2011069* (BRIT). **Columbia Co.**: *Peck 2010095* (BRIT). **Hempstead Co.**: *Peck 2010565* (BRIT). **Lafayette Co.**: *Peck 2011081* (BRIT). **Miller Co.**: *Peck 2011132* (BRIT). **Nevada Co.**: *Peck 2010523* (BRIT). **Ouachita Co.**: *Peck 2011060* (BRIT). **Union Co.**: *Peck 2003132* (BRIT).

Fortune's Holly Fern – **Cyrtomium fortunei** J. Smith var. **fortunei** (Dryopteridaceae)—This species was provisionally listed for Arkansas by Peck (2003) but delisted in Peck (2011) as vouchers had not been deposited or no longer could be found. Recent field work has located plants in Chicot and Desha counties in lowland woods on the Mississippi River side of the batture revetment dikes. These plants were quite mature with more than a dozen fronds each in lowland oak woods not in proximity to human habitation. Peck (2011) concluded that they might be ancient escapes from plantations that may no longer be in evidence (Hoshizaki & Moran 2001; Mickel 2003; Olsen 2007). With these vouchered collections, the species is reinstated to the list of Arkansas pteridophytes.

Voucher specimens: **ARKANSAS: Chicot Co.**: *Peck 2011443* (BRIT). **Desha Co.**: *Peck 2011366* (BRIT).

Autumn Fern – **Dryopteris erythrosora** (Eaton) Kuntze (Dryopteridaceae)—This fern from Japan is commonly planted in southern Arkansas (Hoshizaki & Moran 2001; Mickel 2003; Olsen, 2007). There are many cultivars (Hoshizaki & Wilson 1999), but Arkansas material does not seem to be very divergent from the normal type. To the 7 counties noted in Peck (2011), 14 more counties are reported.

Voucher specimens: **ARKANSAS: Ashley Co.**: *Peck 2011087* (BRIT). **Bradley Co.**: *Peck 2011136* (BRIT). **Calhoun Co.**: *Peck 2010473* (BRIT). **Chicot Co.**: *Peck 2011096* (BRIT). **Clark Co.**: *Peck 2011070* (BRIT). **Cleveland Co.**: *Peck 2011122* (BRIT). **Dallas Co.**: *Peck 2011067* (BRIT). **Desha Co.**: *Peck 2011193* (BRIT). **Hempstead Co.**: *Peck 2010563* (BRIT). **Lincoln Co.**: *Peck 2011072* (BRIT). **Nevada Co.**: *Peck 2010521* (BRIT). **Lafayette** Co.: *Peck 2011081* (BRIT). **Miller Co.**: *Peck 2011022* (BRIT).

Soft Shield Fern – **Polystichum setiferum** (Forsskål) T. Moore ex Woynar (Dryopteridaceae)—This fern native to Great Britain has a long history under cultivation and hundreds of reported cultivars (Dyce 2005), some of which need to be touched to believed as they appear almost artificial in aspect. The plants in our area in the hardy fern trade are erroneously offered under the common name "Alaska Fern" but that name applies to *Polystichum setigerum* (Hoshizaki & Moran 2001; Mickel 2003; Olsen 2007). Using Dyce's cultivar naming system, our material ranges from 'Diversilobum' to 'Plumosum'. Plants occur in lowland woods with moist soils. At the base of stipes of mature plants, vegetatively produced bulbets are evident that might afford some level of vegetative expansion. Plants growing without human care were found in 4 counties in Arkansas.

Voucher specimens: **ARKANSAS: Garland Co.**: *Peck 2011160* (BRIT). **Ouachita Co.**: *Peck 2011205* (BRIT). **Pulaski Co.**: *Peck 2010050* (BRIT). **Union Co.**: *Peck 2003140* (BRIT).

Korean Rock Fern – **Polystichum tsus-simense** (Hooker) J. Smith (Dryopteridaceae—This fern native to Korea was reported for Arkansas for the first time by Peck (2011). It is relatively small compared to other species cultivated in this genus (Hoshizaki & Moran 2001; Mickel 2003; Olsen 2007). Two additional counties are added with this report.

Voucher specimens: **ARKANSAS: Pulaski Co.**: *Peck 2011361* (BRIT). **Union Co.**: *Amason s.n.* (BRIT).

Kunth's Fern – **Thelypteris kunthii** (Desv.) Morton (Thelypteridaceae)—This fern is considered native to the southeastern USA and is commonly planted around houses in the southern half of the state, as it is quite drought resistant (Hoshizaki & Moran 2001; Mickel 2003; Olsen 2007). It is arguable whether the species is native to the state or whether its present distribution is mainly the result of escapes from cultivated plants. It was first noticed as naturalized in Arkansas in Ashley County in the late 1970s. Surely it would have been noticed there or elsewhere in the state earlier than that if it had been native or strongly native. I consider this species to be native to North America but mainly cultivated, escaping, and naturalized in Arkansas. However, there are populations that may have arrived on their own in Arkansas from Louisiana. It may be that its current spread into Arkansas is an admixture of native and naturalized populations. Therefore, I list it here as "native (in part)." With the update records in Peck (2011), 26 county vouchers were then known and reported for this fern in Arkansas. To that we add 10 more county records for a total of 36.

Voucher specimens: **ARKANSAS: Arkansas Co.**: *Peck 2011175* (BRIT). **Desha Co.**: *Peck 2011165* (BRIT). **Hempstead Co.**: *Peck 2010570* (BRIT). **Howard Co.**: *Peck 2010125* (BRIT). **Lincoln Co.**: *Peck 2011157* (BRIT). **Montgomery Co.**: *Peck 2011137* (BRIT). **Phillips Co.**: *Peck 2010115* (BRIT). **Pike Co.**: *Peck 2010100* (BRIT). **Polk Co.**: *Peck 2010120* (BRIT). **Sevier Co.**: *Peck 2010110* (BRIT).

Annotated Checklist of Ferns in Arkansas

The Arkansas fern flora now totals 123 taxa (Table 15) in 44 genera and 22 families, documented and vouchered with 3049 county-level occurrence records. The Arkansas fern flora checklist (Table 15) is arranged in alphabetic order by genus and annotated (1) as to native or naturalized and (2) as to the number of counties from which they have been vouchered in Arkansas. There are now 98 native kinds composed of 84 species, 13 hybrids, two species with two subspecies each and one species with two forms. There are now 25 naturalized kinds composed of 22 species with one species with the typical plus three cultivars.

Table 15. The checklist of Arkansas ferns and fern allies annotated with comments on whether they are native or naturalized in Arkansas and the number of counties from which they are known and vouchered.

ADIANTACEAE	**Status, # cos.**
Adiantum capillus-veneris L.	Native, 29
Adiantum pedatum L. subsp. *pedatum*	Native, 54
Argyrochosma dealbata (Pursh) Windham	Native, 8
Cheilanthes alabamensis (Buckley) Kunze	Native, 14
Cheilanthes eatonii Baker [C. castanea Maxon]	Native, 2; extirpated
Cheilanthes feei T. Moore	Native, 17
Cheilanthes lanosa (Michx.) D.C. Eaton	Native, 40
Cheilanthes tomentosa Link	Native, 37
Pellaea atropurpurea (L.) Link	Native, 41
Pellaea glabella Mett. ex Kuhn subsp. *glabella*	Native 39
ASPLENIACEAE	
Asplenium bradleyi D.C. Eaton	Native, 39
Asplenium montanum Willd.	Native, 1
Asplenium pinnatifidum Nutt.	Native, 23
Asplenium platyneuron (L.) Britton, Sterns & Poggenb.	Native, 75
Asplenium resiliens Kunze	Native, 27
Asplenium rhizophyllum L. [Camptosorus rhizophyllus (L.) Link]	Native, 33
Asplenium ruta-muraria L.	Native, 1
Asplenium septentrionale (L.) Hoffm.	Native, 1
Asplenium trichomanes L. subsp. trichomanes	Native, 39
Asplenium ×ebenoides R.R. Scott (pro. sp.) [A. platyneuron × rhizophyllum] [×Asplenosorus ebenoides Wherry]	Native, 5
Asplenium ×gravesii Maxon [A. bradleyi × pinnatifidum] [×Asplenosorus gravesii Mickel]	Native, 3
Asplenium ×kentuckiensis McCoy [A. pinnatifidum × platyneuron] [×Asplenosorus kentuckiensis Mickel]	Native, 1; extirpated

Asplenium ×trudellii Wherry [A. montanum × pinnatifidum] [×Asplenosorus trudellii Mickel]	Native, 1
AZOLLACEAE	
Azolla microphylla Kaulf. [A. caroliniana Willd., A. mexicana C. Presl, A. mexicana Cham. & Schltdl.]	Native, 60
BLECHNACEAE	
Woodwardia areolata (L.) T. Moore [Lorinseria areolata (L.) C. Presl]	Native, 74
Woodwardia virginica (L.) Sm.	Native, 34
DAVALLIACEAE	
Nephrolepis exaltata (L.) Schott	Naturalized, 1
DENNSTAEDTIACEAE	
Hypolepis tenuifolia (G. Forster) Bernhard.	Naturalized, 3
Dennstaedtia punctilobula (Michx.) T. Moore	Native, 4
Pteridium aquilinum (L.) Kuhn subsp. *latiusculum* (Desv.) Hulten [Pteridium aquilinum (L.) Kuhn var. latiusculum (Desv.) Underw. ex A. Heller]	Native, 75
Pteridium aquilinum (L.) Kuhn subsp. *pseudocaudatum* (Clute) Hulten [Pteridium aquilinum (L.) Kuhn var. pseudocaudatum (Clute) A. Heller]	Native, 75
DRYOPTERACEAE	
Arachniodes simplicior (Makino) Ohwi	Naturalized, 2
Cyrtomium falcatum (L.f.) C. Presl	Naturalized, 12
Cyrtomium fortunei J. Smith	Naturalized, 2
Dryopteris carthusiana (Vill.) H.P. Fuchs	Native, 3
Dryopteris celsa (W. Palmer) Knowlt., Palmer & Pollard	Native, 6
Dryopteris erythrosora (D.C. Eaton) O. Kunze	Naturalized, 16
Dryopteris goldiana (Hook.) ex Goldie) A. Gray	Native, 4
Dryopteris ludoviciana (Kunze) Small	Native, 3
Dryopteris marginalis (L.) A. Gray	Native, 38
Dryopteris ×australis (Wherry) Small [D. goldiana × ludoviciana]	Native, 4
Dryopteris ×leedsii Wherry [D. celsa × marginalis]	Native, 2
Dryopteris celsa × goldiana	Native, 1
Polystichum acrostichoides (Michx.) Schott	Native, 75
Polystichum setiferum (C. Presl) C. Presl	Naturalized, 3
Polystichum tsus-simense (J. Hooker) J. Smith var. *mayebarae* (Tagawa) Sa. Kurata	Naturalized, 3
EQUISETACEAE	
Equisetum arvense L.	Native, 13
Equisetum hyemale L. subsp. *affine* (Engelm.) Calder & Roy L. Taylor [Equisetum hyemale L. var. affine (Engelm.) A.A. Eaton]	Native, 75
Equisetum laevigatum A. Braun	Native, 7
Equisetum ×ferrissii Clute [E. arvense × hyemale subsp. affine]	Native, 75

HYMENOPHYLLACEAE
Trichomanes boschianum J.W. Sturm ex Bosch — Native, 5
Trichomanes intricatum Farrar — Native, 2
Trichomanes petersii A. Gray — Native, 13

ISOETACEAE
Isoetes butleri Engelm. — Native, 41
Isoetes engelmannii A. Braun — Native, 3
Isoetes melanopoda J. Gay & Durieu — Native, 64
[I. melanopoda J. Gay & Durieu f. pallida (Engelm.) Fernald]

LYCOPODIACEAE
Diphasiastrum digitatum (Dill.) Holub — Native, 9
[Lycopodium digitatum Dill.]
Huperzia lucidula (Michx.) Trevis. — Native, 6
[Lycopodium lucidulum Michx.]
Lycopodiella alopecuroides (L.) Cranfill — Native, 15
[Lycopodium alopecuroides L.]
Lycopodiella appressa (Chapm.) Cranfill — Native, 21
[Lycopodium appressum (Chapm.) F.E. Lloyd & Underw.]
Lycopodiella prostrata (R.M. Harper) Cranfill — Native, 8
[Lycopodium prostratum R. M. Harper]
Lycopodiella ×brucei Cranfill [L. appressa × prostrata] — Native, 8
Lycopodiella ×copelandii (Eiger) Cranfill [L. alopecuroides × appressa] — Native, 8
[Lycopodium ×copelandii Eiger]
Lycopodiella alopecuroides × prostrata — Native, 3
Palhinhaea cernua (L.) Franco & Vasc. — Native, 1
[Lycopodiella cernua (L.) Pic. Serm.]
Pseudolycopodiella caroliniana (L.) Holub — Native, 9
[Lycopodiella caroliniana (L.) Pic. Serm.]

MARSILEACEAE
Marsilea macropoda Engelm. ex A. Braun — Native, 2
Marsilea mutica Mett. — Naturalized, 2
Marsilea quadrifolia L. — Naturalized, 2
Marsilea vestita Hook. & Grev. — Native, 18
[M. mucronata A. Braun, Marsilea uncinata A. Braun]
Pilularia americana A. Braun — Native, 14

OPHIOGLOSSACEAE
Botrychium biternatum (Savigny) Underw. — Native, 75
[Sceptridium biternatum (Savigny) Lyon]
Botrychium dissectum Spreng. f. *dissectum* — Native, 33
[Sceptridium dissectum (Spreng.) Lyon]
Botrychium dissectum Spreng. f. *obliquum* (Muhl.) Fernald — Native, 75
Botrychium lunarioides (Michx.) Sw. — Native, 24
[Sceptridium lunarioides (Michx.) Holub]
Botrychium virginianum (L.) Sw. — Native, 75
[Sceptridium virginianus (L.) Holub]
Ophioglossum crotalophoroides Walter — Native, 48
Ophioglossum engelmannii Prantl — Native, 33

Ophioglossum nudicaule L.f.	Native, 22
Ophioglossum petiolatum Hooker	Naturalized, 55
Ophioglossum pycnostichum (Fernald) A. Löve & D. Löve [O. vulgatum L. var. pycnostichum Fernald]	Native, 42
OSMUNDACEAE	
Osmunda claytoniana L.	Native, 2
Osmunda regalis L. var. *spectabilis* (Willd.) A. Gray	Native, 75
Osmundastrum cinnamomeum (L.) C. Presl	Native, 75
POLYPODIACEAE	
Pleopeltis polypodioides (L.) E.G. Andrews & Windham subsp. *michauxiana* (Weath.) E.G. Andrews & Windham [Polypodium polypodioides L. var. michauxianum Weath.]	Native, 75
Polypodium virginianum L.	Native, 22
PSILOTACEAE	
Psilotum nudum (L.) P. Beauv.	Native (in part), 13
PTERIDACEAE	
Pteris multifida Poir.	Naturalized, 3
SALVINIACEAE	
Salvinia minima Baker	Naturalized, 11
Salvinia molesta D.S. Mitchell	Naturalized, 2
SCHIZAEACEAE	
Lygodium japonicum (Thunb.) Sw.	Naturalized, 25
SELAGINELLACEAE	
Selaginella apoda (L.) Spring	Native, 56
Selaginella braunii Baker	Naturalized, 2
Selaginella coralline (Riddell) Wilbur & M.K. Whitson [S. riddellii Van Eselt, Lycopodium corallinum Riddell]	Native, 12
Selaginella eclipes W.R. Buck [S. apoda (L.) Spring subsp. eclipes (W.R. Buck) Skoda]	Native, 35
Selaginella kraussiana (Kunze) A. Braun	Naturalized, 2
Selaginella kraussiana (Kunze) A. Braun 'Aurea'	Naturalized, 2
Selaginella kraussiana (Kunze) A. Braun 'Brownii'	Naturalized, 2
Selaginella kraussiana (Kunze) A. Braun 'Goldtips'	Naturalized, 2
Selaginella rupestris (L.) Spring	Native, 18
Selaginella uncinata (Desv. ex Poir.) Spring	Naturalized,2
THELYPTERIDACEAE	
Macrothelypteris torresiana (Gaudich.) Ching [Thelypteris torresiana (Gaudich.) Alston]	Naturalized, 32
Parathelypteris noveboracensis (L.) Ching [Thelypteris noveboracensis (L.) Nieuwl.]	Native, 12
Phegopteris decursive-pinnata (H.C. Hall) Fee	Naturalized, 1
Phegopteris hexagonoptera (Michx.) Fee	Native, 75
Thelypteris kunthii (Desv.) C.V. Morton	Native (in part), 36

[T. normalis (C. Chr.) Moxley]	
Thelypteris palustris (A. Gray) Schott	
var. *pubescens* (G. Lawson) Fernald	Native, 36
[T. palustris (A. Gray) Schott var. haleana Fernald]	
WOODSIACEAE	
Athyrium angustum (Willd.) C. Presl	Native, 27
[A. filix-femina (L.) Roth var. angustum (Willd.) G. Lawson, A. filix-femina (L.) Roth subsp. angustum R.T. Clausen]	
Athyrium asplenioides (Michx.) A.A. Eaton	Native, 75
[A. filix-femina (L.) Roth var. asplenioides (Michx.) Farw., A. filix-femina (L.) Roth subsp. asplenioides Hulten]	
Athyrium niponicum (Mett.) Hance 'Pictum'	Naturalized, 2
Cystopteris bulbifera (L.) Bernh.	Native, 34
Cystopteris protrusa (Weath.) Blasdell	Native, 49
Cystopteris tennesseensis Shaver	Native, 35
Cystopteris tenuis (Michx.) Desv.	Native, 24
[C. fragilis (L.) Bernh. var. mackayii G. Lawson]	
Cystopteris bulbifera × *tennesseensis*	Native, 3
Cystopteris protrusa × *tennesseensis*	Native, 1
Deparia acrostichoides (Sw.) M. Kato	Native, 12
[Athyrium acrostichoides (Sw.) Diels]	
Diplazium pycnocarpon (Spreng.) M. Broun	Native, 22
[Athyrium pycnocarpon Tidestr.]	
Matteuccia struthiopteris (L.) Tod.	
var. *pensylvanica* (Willd.) C.V. Morton	Naturalized, 23
[US native, but widely planted in northern Arkansas]	
Onoclea sensibilis L.	Native, 75
Woodsia obtusa (Spreng.) Torr. subsp. *obtusa*	Native, 75
Woodsia obtusa (Spreng.) Torr. subsp. *occidentalis* Windham	Native, 43
Woodsia scopulina D.C. Eaton	
subsp. *appalachiana* (T.M.C. Taylor) Windham	Native, 3
[W. appalachiana T.M.C. Taylor]	

Floristic Analysis of Arkansas Pteridophytes

This report is the 15th Arkansas pteridophyte flora (Table 15). Currently, there are 123 kinds of ferns known from Arkansas, including 103 species in 47 genera in 22 families. The 123 kinds include 98 native and 25 naturalized. The 103 species include 83 that are native and 20 that are naturalized. The 103 species are classified in 41 genera and 19 families. To the 83 native species are added 13 hybrids plus two species that are present with two subspecies and one species with two forms to total 98 kinds. To the 20 non-native species are added one species with 3 cultivars growing in the state to total 25 naturalied kinds. With 98 native species known from Arkansas, nearly 20% of the 441 native pteridophytes found in North America north of Mexico occur in Arkansas.

Table 15. Chronology of Arkansas Pteridophyte Floras compared to the present flora.

#	Author	Year	# Taxa	% Present Flora
1.	Nuttall	1835	21	17
2.	Lesquereux	1860	29	24
3.	Harvey	1881	40	33
4.	Branner & Coville	1891	44	36
5.	Buchholz & Palmer	1926	49	40
6.	Moore	1940	55	45
7.	Demaree	1943	56	46
8.	Taylor	1976	65	53
9.	Smith	1978	68	55
10.	Taylor & Demaree	1979	73	60
11.	Taylor	1984	76	62
12.	Peck, Peck, & Taylor	1987	85	70
13.	Smith	1988	86	70
14.	Peck & Taylor	1995	92	75
15.	Peck (this report)	2011	123	100

taxa reported now part of present flora; more were reported, but either lack vouchers, were misidentified, or taxon now lacks present standing.

The fern flora is documented with 3053 county records. There are a mean number of 24.7 county records per taxon (123 kinds) and a mean number of 40.6 taxa (kinds) per county (75 counties) (Table 16). The gradual progression of increases with each subsequent flora shows the magnitude of effort required to produce a flora, even granted that each flora incorporates the sum of all past efforts. The increases in the last 30 years show a focus on rare plant occurrences (Table 15) and an ever expanding number of exotic fern species escaping into the Arkansas landscape (Table 16).

Table 16. Comparison of Arkansas pteridophyte floras reporting county records, showing a gain of 27 taxa and 1275 county-occurrence records since Smith's (1978) atlas of the state vascular flora.

Author (year)	Taxa	Total county-records	mean records/taxon	mean records/co.
Taylor (1976)	65	1321	18.1	17.6
Smith (1978)	68	1288	18.4	17.2
Taylor & Demaree (1979)	74	1335	18.0	17.8
Taylor (1984)	77	1356	17.4	18.1
Smith (1988)	86	1622	18.8	21.6
Peck & Taylor (1995)	92	2224	24.2	29.7
Peck (this report)	123	3053	24.7	40.6

Species Analysis

Sixteen pteridophytes have state-wide distributions and were collected in each of the 75 counties of Arkansas (Table 17). *Pleopeltis polypodioides* might be the most ubiquitous (widespread) Arkansas pteridophyte species. It occurs in all physiographic regions as an epiphyte on a number of tree species (especially open-grown oaks) and sometimes on rocks. *Asplenium platyneuron* and *Polystichum acrostichoides* usually occur on well drained sites and in relatively impermeable soils where few other ferns occur. Only *Woodsia obtusa* subsp. *obtusa* occurs in relatively dry situations, but it too can tolerate more moist sites if in the sun. Eight other species with a nearly state-wide distribution are known from 50 or more counties, including three species with more than 60 counties and four species with more than 50 counties. Again, these tend to be moisture-loving species, with the exceptions of the two subspecies of *Pteridium aquilinum*, which prefer loose soils and well drained locations.

Table 17. 22 state-wide or nearly ubiquitous pteridophytes are known from 50 or more counties of Arkansas.

TAXA NOW KNOWN STATEWIDE	Counties in 1984	Counties in 2011
Asplenium platyneuron	60	75
Athyrium asplenioides	71	75
Botrychium biternatum	38	75
Botrychium dissectum obliquum	7	75
Botrychium virginianum	46	75
Equisetum hyemale affine	30	75
Equisetum ×ferrissi	11	75
Onoclea sensibilis	42	75
Osmunda regalis spectabilis	42	75
Osmundastrum cinnamomea	42	75
Phegopteris hexagonoptera	44	75
Pleopeltis polypodioides	67	75
Polystichum acrostichoides	62	75
Pteridium aquilinum latiusculum	40	75
Pteridium aquilinum pseudocaudatum	41	75
Woodsia obtusa obtusa	53	75
Woodwardia areolata	34	74
Isoetes melanopoda	23	64
Azolla microphylla	12	60
Selaginella apoda	21	56
Ophioglossum petiolatum	4	55
Adiantum pedatum pedatum	40	54
TOTALS	794	1138
Added since 1984		+344

These 22 species (Table 17) are the most ubiquitous in Arkansas, but they are not uniform in abundance across the state. Some are more common in the Gulf Coastal Plain lowlands, such as *Azolla microphylla, Equisetum hyemale* var. *affine, Isoetes melanopoda, Ophioglossum petiolatum, Osmundastrum cinnamomea, O. regalis,* and *Pteridium aquilinum* subsp. *pseudocaudatum.* Others such as *Botrychium biternatum, Onoclea sensibilis, Phegopteris hexagonoptera, Selaginella apoda, Woodsia obtusa* subsp. *obtusa,* and *Woodwardia areolata* are more abundant across the entire southern part of the state, where they are often collected in the Ouachita Mountains and West Gulf Coastal Plain regions. In contrast, *Athyrium asplenioides, Botrychium dissectum* f. *obliquum,* and *Botrychium virginianum* are more abundant to the north and in the Interior Highland region.

Four other species, not so abundant or widely distributed, occur in both the Interior Highlands and Gulf Coastal Plain regions, spread in a more diffuse pattern. These include *Ophioglossum pycnostichum, Pteris multifida, Selaginella arenicola* subsp. *riddellii, Thelypteris palustris* var. *pubescens,* and *Woodwardia virginica. Ophioglossum pycnostichum* is a relatively cryptic species probably overlooked and more common than collected. *Pteris multifida* was established at both localities through some human assistance, so it shows no particular message with its pattern. The last three are far more frequent and abundant in Gulf Coastal Plain habitats but show up sparingly or disjunct in a few other regions in similar habitats or environments. These four species have a diffuse pattern with a few exceptional or anomalous localities, making them harder to classify.

Besides the 22 most ubiquitous species and 5 species of diffuse distribution, an additional 16 species of pteridophytes can be found in the lowlands of the Gulf Coastal Plain, including: *Botrychium lunarioides, Dryopteris ludoviciana, Lycopodiella alopecuroides, L. appressa, L. prostrata, L. ×brucei, L. ×copelandii, L. alopecuroides × X prostrata, Macrothelypteris torresiana, Nephrolepis exaltata, Ophioglossum nudicaule, Palhinhaea cernua, Pseudolycopodiella caroliniana, Psilotum nudum, Salvinia minima, S. molesta,* and *Selaginella apoda.* Another five species occur in the Gulf Coastal Plain and occur in similar habitats found along the Arkansas River Valley region of the Interior Highlands, including *Azolla mexicana, Lygodium japonicum, Marsilea vestita, Ophioglossum crotalophoroides,* and *Thelypteris kunthii.* Altogether, 46 species can be found in the Gulf Coastal Plain of Arkansas.

In contrast, besides the ubiquitous and diffuse species, 43 species are seemingly restricted to the Interior Highlands occur in Arkansas. Species that appear to be restricted to the Interior Highlands of Arkansas include *Adiantum pedatum, Asplenum bradleyi, Asplenum trichomanes, Cheilanthes lanosa, Cheilanthes tomentosa, Dennstaedtia punctilobula, Dryopteris marginalis, Trichomanes intracatum, Trichomanes petersii,* and *Woodsia scopulina* var. *appalachiana.* These plants are all inhabitants of a variety of rock outcrops or rocky, wooded slopes. *Asplenum trichomanes* and *Dryopteris marginalis* are usually found in moist, shaded habitats, while *Cheilanthes tomentosa* occurs on dry, exposed sites. *Adiantum pedatum* occurs in moist, shaded, humus-rich soils, while *Asplennum bradleyi* and *Cheilanthes lanosa* are saxicolous or epipetric plants, usually associated with sandstone outcrops.

Some ferns appear to be restricted to the Ozark Mountains on calcareous rocks. They are most abundant mainly in the northern half of the Ozark Mountains and include *Asplenium resiliens, Cheilanthes alabamensis, C. eatonii, C. feei, C. tomentosa, Argyrochosma dealbata, Pellaea atropurpurea,* and *P. glabella.* Other ferns mostly restricted to the Ozark Mountains include *Asplenium rhizophyllum, Cystopteris tennesseensis, C. tenuis,* and *Diplazium pycnocarpon. Asplenium rhizophyllum, Cystopteris tennesseensis, and C. tenuis* occur on limestone, dolomite, and sandstone outcrops. *Diplazium pycnocarpon* inhabits rich woods, stream banks, and moist, shaded, rocky slopes in this region. *Trichomanes boschianum* is restricted to non-calcareous sandstones.

Some ferns appear to be restricted to the Ouachita Mountains. *Dryopteris celsa, D. Xaustralis,* and *Thelypteris noveboracensis*, which reach their southwestern range limit in Arkansas, are found mostly in the Ouachita Mountains. Here they occur in moist, shaded, rocky woods along streams and seeps.

Another seven species occur in the Interior Highlands and disjunct along seeps and calcareous microsites of Crowley's Ridge in eastern Arkansas, including *Adiantum capillus-veneris, Adiantum pedatum* subsp. *pedatum, Cystopteris protrusa, Deparia acrostichoides, Diplazium pycnocarpon, Equisetum arvense,* and *Ophioglossum engelmannii. Pilularia americana* occurs in lakes, rivers, and dammed lakes and dammed rivers (impoundments) perched high in the Interior Highlands and along the Arkansas River Valley in western Arkansas. Altogether, 76 species of pteridophytes can be found in the Interior Highlands region of Arkansas.

Special Species Affinities

Some sporadically occurring taxa may be recent adventives while other rare and local species may be Pleistocene relicts. Western species such as *Equisetum laevigatum, Cheilanthes eatonii,* and *Pilularia americana* probably arrived some 7 to 5 thousand years ago during the post-Pleistocene hypsothermal (warming maximum) and have decreased into isolated populations with the cooling of the climate since then. Coastal Plain species which occur at or near the northwestern limits of their ranges in Arkansas are *Dryopteris ludoviciana, Pteris multifida,* and *Selaginella corallina.* Species at the edge of their range and with metropolis areas to the north or northeast in eastern North America include *Dennstaedtia punctilobula, Dryopteris carthusiana, Dryopteris celsa, Dryopteris goldiana, Isoetes engelmannii, Huperzia lucidulum, Osmunda claytoniana,* and *Parathelypteris novaboracensis.* These species occur sporadically in Arkansas where they are at the southwestern extent of their ranges. These Arkansas stations may represent relicts surviving from a once wider Pleistocene distribution or from stragglers of past southern migrations during the multiple Pleistocene glaciations.

In contrast, the northeastern flatbranched clubmoss, *Diphasiastrum digitatum*, which occurs in disturbed woodlands or tree plantations, is interpreted as a recent invader from the northeast from recent long-distance spore dispersal or on rootstock planted into regrowth forests. Similarly, *Lygodnum japonicum* and *Macrothelypteris torresiana,* both species not native to the USA, are invading Arkansas from the Southeast into the disturbed pine woods across the southern counties of Arkansas. A similar condition is occurring in our disturbed forested wetlands in southern Arkansas that are now supporting small populations of whiskfern, *Psilotum nudum,* which might have entered from the Southeast as spores in tropical storm events, or in forestry or horticultural soil, or both. *Salvinia minima*, another species not native to the USA, has entered Arkansas in the Delta Region wetlands. The most curious invader is the diminutive *Ophioglossum petiolatum* which has expanded its range across Arkansas southern counties as a frequent lawn weed in rural cemetaries. It original introduction and dissemination may well have been as a weed in potted decorations placed at grave sites, as it has been found in horticultural pots of trees and shrubs in several Arkansas plant nurseries.

The most unusual fern in Arkansas may well be *Trichomanes intricatum.* This endemic species exists in the eastern USA as a gametophyte without a sporophyte generation (Farrar 1992). It was recently proposed (Peck 2011) as occurring in Arkansas based on an anomalous population of *Trichomanes* sp. gametophytes in Stone County. Since then it has also been found in Baxter County [*Peck 99408* (BRIT)]. For many years, the simplest explanation was that this was a relictual New World tropical filmy fern of Triassic age that has persisted in the temperate southeastern USA through the Pleistocene in specially moderated microhabitats called "rockhouses" that accommodated the gametophyte generation but not its sporophyte (Farrar 1998). Evidence for filmy ferns in the southeastern USA during the Triassic is confirmed with fossils (Axsmith, Krings, and Taylor 2001). Recent DNA evidence suggests an alternative phytogeographic origin or relationship, with the nearest

living filmy ferns similar to *T. intricatum* occurring in Asian countries, not Central or South America, belonging to the segregate filmy fern genus of *Crepidomanes* (Ebihara, Ishikawa, Matsumoto, Lin, Iwatsuki, Takamiya, Watano, & Ito 2005; Ebihara, Farrar, & Ito 2008). This genus is restricted to Old World Asian countries. Thus, based on DNA evidence, we are forced into a more elaborate explanation to account for the range and persistence of this sporophyte-less fern species.

Species of Biodiversity Concern

In the Natural Area Plan that summarized Arkansas' biodiversity, Tucker (1976) listed 10 pteridophytes that might be considered endangered or possibly endangered within Arkansas. Since then, with increased attention focused on their status stimulating more field work, some of the species appear to be more common than thought. Clearly, separating species that were under-collected or not well enough known is an important step in identifying species that remain of biological concern based on a continued limited number of county occurrences (Table 18).

Table 18. Based on Tucker (1974), 10 pteridophytes were Endangered or Possibly Endangered in Arkansas.

Tucker's names	Modern names	1974 status	No. of counties 1974	2011
Lycopodium adpressum	Lycopodiella appressa	E	5	21
Lycopodium lucidulum	Huperzia lucidula	E	2	6
Selaginella riddellii	Selaginella coralline	E	2	12
Selaginella rupestris	Selaginella rupestris	E	8	18
Osmunda claytoniana	Osmunda claytoniana	E	2	2
Trichomanes boschianum	Trichomanes boschianum	E	4	5
Trichomanes petersii	Trichomanes petersii	E	2	13
Dennstaedtia punctilobula	Dennstaedtia punctilobula	E	2	4
Woodsia scopulina	Woodsia scopulina	E	1	3
Pilularia americana	Pilularia americana	E	6	14
Equisetum arvense	Equisetum arvense	PE	6	13
Marsilea mucronata	Marsilea vestita	PE	5	9
		Totals	45	120

Based on his dissertation research, Carl Taylor reported 18 species and hybrids of Arkansas pteridophytes that were known from three or fewer counties in Arkansas (Taylor 1976; Taylor & Demaree 1979; Taylor 1984). For these and other species of biodiversity concern (Table 19), collection since 1984 has added appreciably to their known distributions or confirmed that they are truely rare in Arkansas. Two ferns are proposed as extirpated. One species was tracked but no new populations were noted. Twenty-seven species were found at additional sites and in additional counties. With recent discoveries since 1984 (Tables 18 + 19), additional species have been added to the list of Arkansas pteridophytes of biodiversity concern, while others have been removed. Four taxa were discovered in 20 or more additional counties. Nine taxa were discovered in 10 or more additional counties. Nine taxa remain known from 4 or fewer counties.

Table 19. Based on Taylor (1984), 30 native Arkansas pteridophytes were known from 7 or fewer counties in 1984 but most are better known today.

Rare Taxa Known From 7 or Fewer Co. in 1984	Counties Records in 1984	Counties Records in 2011	Status Change
Asplenium ×kentuckiense	1	1	extirpated
Cheilanthes eatonii	2	2	extirpated
Osmunda claytoniana	2	2	unchanged
Dryopteris ×leedsii	1	2	+ 1
Asplenium ×gravesii	1	3	+ 2
Dryopteris carthusiana	1	3	+ 2
Dennstaedtia punctilobula	2	4	+ 2
Pteris multifida	1	3	+ 2
Woodsia scopulina	1	3	+ 2
Argyrochosma dealbata	5	8	+ 3
Dryopteris celsa	3	6	+ 3
Trichomanes boschianum	2	5	+ 3
Huperzia lucidulum	3	6	+ 3
Asplenium ×ebenoides	1	5	+ 4
Parathelypteris noveboracensis	7	12	+ 5
Equisetum arvense	6	13	+ 6
Equisetum laevigatum	1	7	+ 6
Deparia acrostichoides	5	12	+ 7
Pilularia americana	6	14	+ 8
Selaginella coralline	4	12	+ 8
Trichomanes petersii	4	13	+ 9
Marsilea vestita	6	18	+ 13
Lycopodiella appressa	5	21	+ 16
Asplenium pinnatifidum	6	23	+ 17
Ophioglossum nudicaule	4	22	+ 18
Botrychium lunarioides	4	23	+ 19
Thelypteris kunthii	1	36	+ 35
Botrychium dissectum dissectum	2	33	+ 31
Ophioglossum petiolatum	4	55	+ 51
Botrychium dissectum obliquum	7	75	+ 68
TOTALS	88	442	+354

An alternative reason for being known from relatively few counties is being only recently reported from the state. Table 20 lists all native taxa discovered within Arkansas since Taylor (1984). Three species were discovered and already are known from more than 20 counties. The remaining 17 are known from 15 or fewer counties. Eleven are known from four or fewer counties, suggesting that they remain relatively rare in Arkansas. Their presence in few counties as of this report, following 30 years of effort to determine their presence and distribution within Arkansas, now presents strong evidence that they are indeed quite rare in Arkansas.

Table 20. Twenty native taxa were added to the Arkansas pteridophyte flora since 1984. Eleven remain known from four or fewer counties.

Added to flora since 1984	Year Reported	Counties in 2011
Dryopteris ×australis	Orzell & Peck (1985)	4
Dryopteris ludoviciana	Peck et al. (1985b)	3
Pseudolycopodiella caroliniana	Peck & Peck (1986)	9
Lycopodiella alopecuroides	Peck & Peck (1986)	15
Lycopodiella prostrata	Peck & Peck (1986)	8
Lycopodiella ×bruceii	Peck & Peck (1986)	8
Lycopodiella ×copelandii	Peck & Peck (1986)	8
Lycopodiella alopecuroides × prostrata	Peck & Peck (1986)	3
Diphasiastrum digitatum	Peck & Peck (1988)	9
Woodsia obtusa occidentalis	Windham (1993)	43
Cystopteris tenuis	Peck & Taylor (1995)	24
Cystopteris protrusa × tennessensis	Peck & Taylor (1995)	1; unknown
Cystopteris bulbifera × tennessensis	Peck & Taylor (1995)	3; unknown
Palhinhaea cernua	Bray (1996)	1; extirpated
Dryopteris goldiana	Peck et al. (1999)	4
Dryopteris celsa × goldiana	Peck et al. (1999)	1
Isoetes engelmannii	Thomas et al. (1999)	3
Asplenium montanum	Peck (2011)	1
Asplenium ruta-muraria	Peck (2011)	1
Asplenium septentrianale	Peck (2011)	1
Asplenium ×trudellii	Peck (2011)	1
Athyrium angustum	Peck (2011)	27
Marsilea macropoda	Peck (2011)	2
Trichomanes intricatum	Peck (2011)	2

Exotic Component of Arkansas Fern Flora

Rarity might also be an indication of recent introduction of an exotic, non-native, or non-indigenous species. Non-native but naturalizing ferns were not collected in Arkansas until 1941. By 1984, only 4 non-native species were known in Arkansas and those were in 7 counties. Today, 28 species are present in Arkansas in 338 county occurrences that are escapes to fully naturalized or are not entirely native or are wholely non-native (Table 21). Most occur in southern Arkansas and are more abundant there. Many of those reported by Peck (2011) are only recently escaped and express varying degrees of "naturalization" at varying distances from source plants. This increase in the number of kinds and expansion of their range in Arkansas is a direct result of the availability of exotic hardy ferns and the extent to which gardeners enjoy growing them.

After watching the spread of some species entirely on their own, my attention over the last 10 years was directed toward the garden cultivation of ferns and their escapes and affinities for disturbed safe sites as a result of road maintenance, timber harvest, and wetland management. Species in Arkansas that might exist in native and in naturalized mixtures are *Psilotum nudum* and *Thelypteris kunthii*.

Recent efforts to survey and document their extent of presence in Arkansas also confirmed that they have yet to pose any economic or ecologic damage requiring their listing as invasive plants. The two species with the most obvious human intervention in their occurrence are also the least widespread within the state (*Nephrolepis exaltata* and *Pteris multifidum*). One species was obviously planted around homes in the upland counties, *Matteuccia struthiopteris*, and it persists at many locations with only a few instances where it appears to have appreciable expanded into adjacent wet draws or ravines. Only two species occur as truly aquatic and potentially invasive (*Salvinia minima* and *S. molesta*), but they have yet to demonstrate unmanageable populations in Arkansas. They might be constrained by severe winters or by summer droughts. They should be closely watched. The other exotic ferns in Arkansas are terrestrial to epipetric but favor moist soils at the edges and in openings of disturbed woodlands, particularly in southern Arkansas. The climbing fern *Lygodium japonicum* has not become a serious invasive or increased fire hazards in our pine plantations in southern Arkansas.

The change in distribution of a species range in Arkansas is not restricted to exotics. Some native fern species are also spreading west and south, such as *Diphastastrum digitatum*. Many of the Gulf Coastal Plain clubmosses in Arkansas appear to be spreading farther northward, but many of the original populations now are on the wane as the site continues to develop into more advanced successional stages. These too are native to Arkansas but certainly have benefited from soil disturbance from barrow pit development and timber access road construction and maintenance.

Table 21. The exotic component (non-native and naturalized) of the Arkansas pteridophyte flora appears to be increasing in the field and is now better documented.

Non-native Pteridophytes	First State Report	Counties in 1984	Counties in 2011
Pteris multifidum	Chandler (1941)	1	2
Ophioglossum petiolatum	Thomas (1978)	4	54
Macrothelypteris torresiana	Taylor & Johnson (1979)	1	17
Thelpteris kunthii	Taylor & Johnson (1979)	1	36
Lygodium japonicum	Taylor (1984)	1	14
Psilotum nudum (in part)	Bray et al. (1994)	-	13
Salvinia minima	Peck (1997)	-	11
Nephrolepis exaltata	Peck (2002)	-	1
Cyrtomium falcatum	Peck (2003)	-	12
Dryopteris erythrospora	Simpson et al. (2006)	-	21
Marsilea quadrifolia	Simpson et al. (2006)	-	3
Arachniodes simplicior	Peck (2011)	-	2
A. niponicum 'Pictum'	Peck (2011)	-	2
Hypolepis tenuifolia	Peck (2011)	-	3
Marsilea mutica	Peck (2011)	-	2
Mattueccia struthiopteris	Peck (2011)	-	23
Polystichum tsus-simense	Peck (2011)	-	3
Phegopteris decursive-pinnata	Peck (2011)	-	1
Salvinia molesta	Peck (2011)	-	2
Selaginella braunii	Peck (2011)	-	2
S. kraussiana	Peck (2011)	-	2
S. k. 'Aurea'	Peck (2011)	-	2
S. k. 'Brownii'	Peck (2011)	-	2

S. k. 'Goldtips'	Peck (2011)	-	2
Selaginella uncinata	Peck (2011)	-	2
Cyrtomium fortunei	Peck (present report)	-	2
Polystichum setiferum	Peck (present report)	-	3
	Total County-level Records	8	338

Future Challenges

Continued field assessments of the rarest Arkansas pteridophytes must be conducted to certify their status in the biodiversity of Arkansas. Twenty-five taxa (20%) of the 123 taxa in the Arkansas pteridophyte flora are known from 5 or fewer counties (Table 22). Three taxa (2%) appear to be of extirpated occurrence (*Asplenum ×kentuckiense*, *Palhinhaea cernuua*, and *Cheilanthes eatonii*). Eight taxa require additional field search. The five clubmosses on the Gulf Coastal Plain are of unknown field status as their populations are short-lived, in early successional status, and are not very stabile (5 clubmosses have 8 or fewer county records). Old collections of uncertain location (two *Cystopteris* hybrids and *Cheilanthes eatonii*) are difficult to access on rocky bluffs. About a dozen are known from less than 20 plants or clones, plus another half-dozen are known from a few hundred plants. Several species have lost complete populations of the few known in Arkansas. The large proportion of the Arkansas pteridophyte flora of precarious status is a stimulus to know more about the species biology of pteridophytes in the Natural State.

Table 22. Floristic status of the 25 rarest native Arkansas pteridophytes found in 5 or fewer counties.

Name	# counties in 2011	Status
Asplenium montanum	1	4 plants
Asplenium ruta-muraria	1	3 plants
Asplenium septentrianale	1	6 plants
Asplenium ×gravesii	1	1 plant
Asplenium ×kentuckiense	1	extirpated
Asplenium ×trudellii	1	1 plant
Cystopteris protrusa × tennesseensis	1	unknown in field
Dryopteris celsa x goldiana	1	1 clone
Palhinhaea cernuua	1	extirpated
Cheilanthes eatonii	2	extirpated
Dryopteris ×leedsii	2	less than 12 plants
Marsilea macropoda	2	2 clones
Osmunda claytoniana	2	2 major clones
Trichomanes intricatum	2	2 major clones
Woodsia scopulina	2	100 plants/extirpated
Asplenium ×ebenoides	3	fewer than 12 plants
Cystopteris bulbifera × tennesseensis	3	unknown in field
Dryopteris carthusiana	3	fewer than 100 plants
Dryopteris ludoviciana	3	1 extirpated; 2 clones
Isoetes engelmannii	3	3 populations
Lycopodiella alopecuroides × prostrata	3	unknown & short-lived
Dryopteris goldiana	4	fewer than 12 plants

Dryopteris ×australis	4	300+ plants
Trichomanes boschianum	4	fewer than 12 clones
Dryopteris celsa	5	1 extirpated/ 200+ plants

When Carl Taylor's field guide to Arkansas ferns and fern allies was published in 1984, he reported 77 kinds of pteridophytes with 1356 county level occurrence records or map dots on the distribution maps. Today, we know of 123 kinds with 3053 dots on the maps. That means that in the last 30 years, an additional 46 kinds of ferns with an additional 1697 county-level dots were added. With the rugged terrain of swamps, outcrops, and bluffs, it is very likely additional kinds and populations await discovery. With each year, new tropical storms bring possibilities of new arrivals. Each collector and flora report summarized what was known at that time, hoping to nudge a successor to continue the collective exploration of Arkansas started so long ago by Thomas Nuttall.

Analysis by County

The Interior Highland Region, comprised of 38 counties, averages 50.5 pteridophytes per county flora and contributes 1917 county records (50.5% of total). The 25 Arkansas counties with the greatest number of pteridophyte kinds in their floras all are within the Interior Highland Region (Table 23). In general, counties with greatest elevation, topographic relief, and largest number of habitat types have the greatest number of pteridophytes. Similarly, rugged topography, particularly narrow and deep East/West running valleys, results in high numbers of pteridophytes known from most counties in the Ozark Region lying north of the Arkansas River. The counties with major aerial extent within the Arkansas Valley Region lowlands have fewer species. Scott County with 36 species in its flora has the least of the county pteridophyte floras within the Interior Highland Region. This may reflect a minimal topographic relief for the region, uniform bedrock, and lower rainfall than found in most Arkansas counties. Adjacent Logan County has but one major feature (Magazine Mountain, 3000+ ft of elevation, greatest in state) that accounts for most of its 53 species. Certainly, mountainous terrain favors pteridophyte occurrences. Interestingly, Garland Co. has the greatest county pteridophyte flora (83) and lies somewhat isolated in the Ouachita Mountain region. All counties with major aerial extent in the Ouachita Mountain Region have high numbers of pteridophytes in their floras, reflecting their rugged rock exposures, marked topographic relief, and a higher rainfall from large fronts and summer air masses arriving from the south and rising to get over the Ouachita Mountains.

The 37 counties of the Interior highlands of Arkansas may be further separated into two regions: the Ozark Region north of the Arkansas River with 25 counties and south of the Arkansas River the Ouachita Mountain Region with 12 counties. The Ozark region counties average 48.7 pteridophytes in their floras while the Ouachita Mountain region counties average 58.4 pteridophytes.

The Interior Lowlands region of Arkansas, comprised of 37 counties, averages 30.6 pteridophytes per county flora and contributes 1136 county records (37.1% of total). The 20 Arkansas counties with the fewest kinds of pteridophytes in their floras all are within the Interior Lowlands, particularly the Mississippi Delta region (Table 24). The counties with the least number of pteridophytes tend to lie to the west of Crowley's Ridge or between Crowley's Ridge and the Mississippi River (Table 24).

Table 23. The top 25 pteridophyte county floras in Arkansas all occur in counties of the Interior Highlands Region.

# Taxa	Counties
82	Garland
73	Pulaski
62	Baxter
61	Stone
60	Montgomery
56	Hot Spring
55	Newton, Saline
54	Clark, Pope
53	Izard, Logan
52	Polk, Van Buren
51	Benton, Cleburne, Independence, Johnson, Marion, Pike
49	Boone, Carroll, Madison
48	Fulton, Washington

Counties that straddle Crowley's Ridge have more species in their diverse microhabitats than those adjacent flat counties with less relief, which are more intensively ditched, drained, and converted to row crops. Counties in the southern Gulf Coastal Plain Region support forestry today, although they once were more agricultural 150–100 years ago. In general, the closer the Interior Lowland counties are to Louisiana or Texas, the greater the number of pteridophytes in their flora. Also, Bradley, Drew, and Union counties have the greatest fern floras of the Interior Lowland counties, being subjected to more scrutiny than the other border counties through the years.

The Interior Lowlands of Arkansas may be separated into two regions: the Mississippi River Delta region (20 counties) and the Gulf Coastal Plain region (18 counties). The Mississippi River Delta counties average 25.8 pterdiophytes in each of their floras, while the Gulf Coastal Plain counties average 32.1. Probably current land use explains much of this pattern, in that the Mississippi Delta was early converted from timber harvest, being ditched and then drained to produce new fields. The new fields were put into cotton and with modern technology into row crops, rice production, with some old field reversion, and conserved swamps for aquifer recharge. The Gulf Coastal Plain is devoted to pine plantation forestry, extractive aggregates, petroleum, gas, and soon lignite, or pasture for ranching, with swamps conserved for aquifer recharge. In the eastern Gulf Coastal Plain, much of it was historically cleared, ditched, and drained for cotton production and has reverted to old field and thence into modern pine timber production. The pteridophytes in these counties are very much restricted to ditches and the few swamps that remain.

Table 24. The 20 smallest pteridophyte county floras in Arkansas all occur in counties of the Interior Lowlands, particularly the Mississippi Delta region.

# Taxa	Counties
20	Mississippi

21	Crittenden, Poinsett
22	Prairie, Woodruff
23	Craighead, Lonoke
24	Cross
25	Chicot, Clay, Monroe, St. Francis
26	Lee
27	Greene, Phillips
29	Arkansas, Desha
31	Jackson
32	Cleveland, Lincoln

Major Herbaria with Arkansas Ferns

There are more than a dozen herbaria in Arkansas with specimens of Arkansas ferns and fern allies. They range in size from the large collection at the University of Arkansas at Fayetteville (approximately 100,000 specimens of vascular plants) to small collections with a few specimens but which might be quite important as they are not duplicated elsewhere.

Specimen vouchers that document the Arkansas flora are also found in herbaria outside Arkansas. The largest holding of Arkansas ferns outside the state of Arkansas is at Fort Worth, Texas (BRIT-SMU-VDB). In the course of preparing this text the author has visited or seen specimens from nearly two dozen herbaria to provide a complete account of the flora and its documentation (Table 25).

Table 25. Herbaria with major holdings of specimens documenting the pteridophyte flora of Arkansas are found within and outside of Arkansas.

Herbarium Institution	ACRONYM or CODE
Arkansas herbaria	
Arkansas Natural History Commission, Little Rock, AR	ANHC
Arkansas Tech University, Russellville, AR	APCR
Henderson State University, Arkadelphia, AR	HSU
Hendrix College, Conway, AR	HXC
University of Arkansas at Little Rock, Little Rock, AR [ferns]	LRU moved to BRIT
Lyon College (Arkansas College), Batesville, AR	"LYON"
Arkansas State University, Jonesboro, AR	STAR
University of Arkansas at Monticello, Monticello, AR	UAM
University of Arkansas at Fayetteville, AR	UARK
University of Central Arkansas, Conway, AR	UCAC
Hot Springs National Park, Hot Springs, AR.	"HSNP"
Out-of-state herbaria	
Botanical Research Institute of Texas, Fort Worth, TX	BRIT
Field Museum of Natural History, Chicago, IL	F
Harvard University Herbaria, Cambridge, MA	A, GH
University of Memphis, Memphis, TN	MEM moved to TENN
Milwaukee Public Museum, Milwaukee, WI	MIL moved to WIS
Missouri Botanical Garden, St. Louis, MO	MO

University of North Carolina, Chapel Hill, NC	NCU
University of Louisiana - Monroe, Monroe, LA	ULM (MLU)
New York Botanical Garden, Bronx, NY	NY
Academy of Natural Sciences, Philadelphia, PA	PH
Southern Illinois University, Carbondale, IL	SIU
Southwest Missouri State University, Springfield, MO	SMS
Southern Methodist University, Dallas, TX	SMU moved to BRIT
University of Tennessee, Knoxville, TN	TENN
University of Missouri, Columbia, MO	UMO
Vanderbilt University, Nashville, TN	VDB moved to BRIT
Museum of Natural History, Smithsonian Institution, Washington, DC	US

The importance of the herbarium collections is greater than their sum. If no one ever made and deposited an herbarium specimen as a voucher, no one could ever know the whole fern flora of Arkansas. No one person has seen all 123 kinds in the wilds of Arkansas. Vouchers were not seriously and systematically collected and archived in Arkansas until the 1920s. Without the many vouchers of Ernest J. Palmer, Delzie Demaree, and Dwight Moore, we would not know the extent of the richness of our natural heritage. Demaree collected more than 70,000 specimens of Arkansas plants. No one since has seen that many, much less collected that many, in Arkansas. Recently, R. Dale Thomas of University of Louisiana at Monroe collected nearly 170,000 specimens, more than anyone else, period. Some of Thomas's collections were ferns from southern Arkansas, particularly the small cemetery ferns found in the genera *Botrychium* and *Ophioglossum*. It is unlikely that anyone else can or will ever repeat or duplicate his total field effort.

The era of the professional plant collector appears to be over within the USA. Workers in agencies and universities are now more concerned with management, restoration, endangered species recovery, or invasive species biology than with alpha level floristics. With the preservation of all past collectors' specimens in herbaria, researchers are rapidly databasing records to assess species and counties that remain under-collected. Stewardship of these potentially forensic holdings of plant vouchers of our flora is now as large a problem as determing what our biodiversity once was.

Over the last 190 years, the pteridophyte floristic research in Arkansas has changed focus and emphasis. Initially, it was to know the names of the plants to be found in the state, then in the 1920s to begin documentation of their county distributions. Since 1980 more attention has been placed on knowledge of population status, knowledge of whether old collections represent now extirpated taxa, and a concern for restoration that requires knowing more about individual species biology. In this century, the management emphasis of exotic invasive and naturalizing species from cultivation to natural areas' exotic species still requires data mining of herbarium vouchers.

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ARTHRAXON HISPIDUS (POACEAE) IN TEXAS: UPDATE

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ABSTRACT

A second population of *Arthraxon hispidus* (Thunb.) Makino in Texas is documented, considerably west of the one reported in 1991 in Cass County. These plants are growing in abundance along the street curb of a watered lawn in Fort Worth. Photos are provided.

Arthraxon hispidus (Thunb.) Makino was first reported as naturalized in Texas by Brown and Schultz (1991) from a population in Cass County, in the northeastern corner of the state. There have been no other published reports (Diggs et al. 2006) and no additional collection of the species exists in BRIT-SMU, SBSC, TAMU, or TEX-LL. It is documented in the present report as a lawn weed in Fort Worth, more than 150 miles west of the locality in Cass County.

Texas. Tarrant Co.: population along about 30 feet of a watered lawn bordering the concrete street curb, Spanish Oak Drive near jct with Glenwood Drive at Overton Park, with dominant St. Augustine grass (*Stenotaphrum secundatum*) and scattered *Digitaria* and *Cynodon*, fruits just beginning to mature, 14 Aug 2011, *G.L. Nesom 2011-11* (BRIT, TEX). Figures 1–5.

Plants of *Arthraxon hispidus* (small carp grass, jointhead grass, basket grass) are distinctive in their lanceolate to ovate-lanceolate leaves with auriculate-clasping bases, racemes in a digitate cluster, and creeping habit, stems rooting at lower nodes. According to Thieret (2003), plants in the USA belong to var. *hispidus*, "the most widespread and variable of the four varieties." Chen and Phillips (2006) have characterized it as "an extremely polymorphic, polyploid species [$2n$ = 10, 18, 36] to which many names have been applied, both at specific and infraspecific rank." Kiger (1971) noted that spikelet length and presence of awns are variable even within populations in the USA and the native range, but these features are relatively uniform in the Fort Worth population. Because of the habit and leaves, *A. hispidus* without flowers bears a superficial resemblance to *Commelina communis* Also it is "sometimes confused (especially before flowering) with *Microstegium*, but *Arthraxon* has distinctly cordate-clasping leaves, which *Microstegium* lacks. Also vegetatively similar to *Oplismenus*" (Weakley 2011).

Arthraxon hispidus is native to Japan, China, Taiwan, Philippines, Indochina, New Guinea, Sri Lanka, Kashmir, and India (Kiger 1971; Van Welzen 1981; Thieret 2003). The species has become naturalized in Mexico, Central America, Hawaii (GCW 2011), and recently in Iran (Hamzeh'ee & Naqinezhad 2009). In the USA, its early advent was summarized and documented by Kiger (1971) and its current wide and abundant distribution in the eastern USA is mapped by Kartesz (2011).

Weakley (2011) notes that *Arthraxon hispidus* appears to be steadily increasing its abundance in the southeastern USA, where it commonly occurs in moist disturbed areas such as ditches, roadsides, fields, gardens, and pavement crevices and in bottomlands and low woods, on sand bars, and along shores of streams and lakes (Kiger 1971). It seems likely that the species already occurs elsewhere in east Texas since it is well-documented in Arkansas, Louisiana, and eastern Oklahoma. *Arthraxon hispidus* has been known to occur in Arkansas and Louisiana at least since 1950

(Hitchcock 1950). In fact, the lack of observations or reports of its weedy occurrence in Texas seems unusual, unless its westward spread has slowed.

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Figures 1–5. *Arthraxon hispidus* along street curb of lawn in Fort Worth, Texas. Photos 14 August 2011

Figure 2 Above.

Figure 3.

Figure 4a and 4b. Mature to nearly mature infructescences.

Figure 5. Note long cilia on leaf margins in the area of the auriculate-clasping base.

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KALLSTROEMIA PARVIFLORA (ZYGOPHYLLACEAE) NEW TO LOUISIANA

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ABSTRACT

Kallstroemia parviflora Norton is documented as naturalized in Louisiana from a population in Shreveport, along the Caddo and Bossier Parish line.

KEY WORDS: *Kallstroemia parviflora*, Zygophyllaceae, Louisiana

On 25 July 2011, we discovered *Kallstroemia parviflora* Norton, also known as caltrop, to be common along a 3 km stretch of the Southern Extension of the Clyde E. Fant Memorial Parkway in Shreveport, Louisiana, centered on 32°28' 38.99" N, 93°41' 28.83" W, at about 70 meters elevation (Figs. 1, 2, 3). *Kallstroemia parviflora* has previously been reported from Mississippi, Missouri, Illinois, Texas, Oklahoma, Kansas, and westward but not from Louisiana or Arkansas (MacRoberts 1984, Smith 1994, Thomas & Allen 1998, Turner et al. 2003, Kartesz & Meacham 2005, NatureServe 2011, USDA Plants 2011). Its closest known location is in Gregg County, Texas (Turner et al. 2003), about 100 km west of the Louisiana locality. Specimens were collected (*MacRoberts & MacRoberts 8900, 8901, 8903, 8904*) and deposited at LSUS and LSU.

Figure 1. Aerial showing Caddo and Bossier Parish boundaries (yellow line) and the two parkways described in the text.

The Clyde Fant Parkway is on the Red River alluvial plain and parallels the river, being variously between 100 and 400 m from it. There are no buildings between the parkway and the river. The land is either pasture or mowed park and parkway right-of-way, and the parkway is highly disturbed and frequently mowed. This probably has assisted *Kallstroemia parviflora* because of its low sprawling habit. Associated species include *Cenchrus spinifex, Chamaesyce maculata, Chrysopsis pilosa, Coronopus didymus, Cynodon dactylon, Eragrostis minor, Mollugo verticillata, Oenothera laciniata, Paspalum notatum, Polygonum aviculare, Portulaca oleracea,* and *Tribulus terrestris*, half of which are not natives.

Whether or not the species has been brought into this area by human activity is not known, but road construction and frequent mowing may have been responsible for its presence and have contributed to its spread. It does occur on the deposition side of the river and since *Kallstroemia parviflora* is common in north-central Texas and south-central Oklahoma (Kartesz & Meacham 2005; Turner et al. 2003) it could have been transported down the river naturally.

Politically, and ironically, this *Kallstroemia parviflora* population occurs in both Bossier and Caddo parishes, because while it occurs on the west (Caddo Parish) side of the Red River, small bits of Bossier Parish also occur on the west side of the Red River because the river, which was the original parish boundary in the mid-1800s, has changed course through natural meander and man-made alterations ("cutoffs") (Joiner 2006). Thus, while the center of the population is politically or technically in Bossier Parish, ecologically and biogeographically this area should be considered to be Caddo Parish until populations are found on the east side of the river. We searched for *K. parviflora* along the frequently mowed A.R.Teague Parkway on the Bossier Parish side of the river but found none.

Figure 2. *Kallstroemia parviflora* on the Clyde Fant Parkway, habit.

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Figure 3. *Kallstroemia parviflora* on the Clyde Fant Parkway, flowers.

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MONARDA LUTEOLA (LAMIACEAE): A NEW SPECIES FROM NORTHEAST TEXAS AND SOUTHWEST ARKANSAS

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ABSTRACT

Monarda luteola, characterized by pale yellow flowers, is described as new. The species is limited in distribution to the Weches Formation of northeast Texas and adjacent Miller County, Arkansas. It is similar to and compared with *Monarda lindheimeri* of southwest Louisiana and southeastern Texas.

KEY WORDS: Lamiaceae, *Monarda*, *Monarda* sect. *Eumonarda*, Texas, Arkansas, Louisiana

Monarda lindheimeri Englem. & A. Gray, *M. fistulosa* L., and *M. russelliana* Nutt. ex Sims belong to a group of *Monarda* characterized by a single terminal flower cluster and flowers with the stamens exserted beyond the upper lip. This group was assigned the section name *Eumonarda* by Bentham (1835). McClintock & Epling (1942) referred to this name as a subgenus, but without correct name-bringing. Nonetheless, ISBN Art. 21.3 makes this name illegitimate. The three species are normally distinguished by flower color. *Monarda fistulosa* and *M. russelliana* have lavender to pink colored flowers, and, in *M. russelliana*, a red spotted lower lip. The flower color of *M. lindheimeri* has been variously described as "pallid" (McClintock & Epling (1942), "creamy white" (Correll & Johnston 1970), and "white" (Turner 1994). Basically, if a member of this group from east Texas has "white" flowers, it will likely key to *M. lindheimeri* in the mentioned works. An exception is *M. fistulosa* with albino flowers, which almost always has traces of pink or lavender, particularly in the veins.

Field studies in northeast Texas and adjacent Miller County, Arkansas, during the past several years have resulted in the recognition of a yellow flowered *Monarda* that has affinities with the group described above. These plants, which are limited in distribution to the clay iron ore hills of the Weches Geological Formation (University of Texas Bureau of Economic Geology 1979) of northeast Texas and adjacent Miller County, Arkansas, are here described as a new species.

Monarda luteola Singhurst and W. C. Holmes, sp. nov. (Fig. 1). **TYPE**: **Texas**. Morris County.: "Kennedy Mountain," 0.7 mile S of jct. of Farm Market Hwy 144 and County Road 2216 (White Road); N 32° 58' 31.04", W 94° 46' 47.44"; 24 May 2008, *W.C. Holmes & J.R. Singhurst 14012* (holotype: BAYLU; isotypes: Jarvis College, Hawkins, Texas; others to be distributed).

Monardae lindheimeri Engelm. & A. Gray similis sed differt foliis lanceolatis vel lanceolati-triangularibus basibus rotundatis vel truncatis vs. foliis ovatis vel deltatis basibus subcordatis vel cordatis.

Aromatic (with odor of lemon) perennial herb 40–66 cm tall; rhizomes 1.1–2.2 mm thick, 15 or more cm long; aerial stems erect, square, purplish-reddish or lined purplish-red at the angles; glabrate to sparingly to densely hirsute-hispid; internodes 4–6 or more cm long, mostly shorter than subtending leaves. Leaves opposite; petioles 4–11 mm long, sparingly to densely hirsute; blades of midstem leaves lanceolate to lanceolate-triangular; 4.3–8.4 × 2.3–3.7 cm, gradually shortening above and nearly sessile at the summit, basal leaves, if persisting smaller, leaves of sterile shoots larger and wider; surfaces hirsute-hispid; bases rounded-truncate to an acute insertion at the petiole to obscurely subcordate; margins coarsely serrate, teeth 3–7 mm distant, hirsute-hispid; venation pinnate with 8–10 pairs of hispid-hirsute secondary nerves evenly spaced over the blade; lower surfaces glandular-punctate and densely to moderated hispid-hirsute; upper surfaces moderately appressed hirsute and glandular punctate; apices acuminate. Glomerules one per stem, terminal, 2–3.5 cm wide (excluding corollas); bracts subfoliaceous, outer ovate, to 4.0 × 2.4 mm, hirsute-hispid to pubescent to calyx-like, apices awned, the inner bracts similar, smaller. Pedicels 0.2–0.5 mm long, glabrate to glandular-puberulent. Calyx tubular, ca. 10 mm long (not including awns), 10–13 nerved, surfaces puberulent with gland-tipped hairs; orifice teeth deltate, the orifice itself comose, the hairs about 0.8 mm long; awns 2.8–3.5 mm long, sparingly glandular and occasionally with glandular hairs. Corolla pale yellow, length 2.8–3.1 cm; tube 2.2 cm, basal portion glabrate, above glandular-atomiferous, pubescent; throat 0.8–1.1 mm, upper lip ca. 8 mm, glandular, pubescent, lower lip ca. 9 mm, glandular, pubescent. Carpels 2, deeply lobed and appearing as 4, ca. 1.3 mm tall; anthers 2, originating from the upper inner surface of corolla about 2 mm from the tips, filaments slender, ca. 18 mm long, 2-winged, each ca. 0.2 mm wide, anthers dorsifixed, 2.5 mm long. Styles ca. 3.6 cm long, winged (as anthers, *q.v.*); stigmas 2, anterior ca. 1.5 mm long, flattened-clavate, posterior vestigial to about 1 mm long. Nutlets 4, ellipsoid, 1.4–1.5 × 0.8–0.9 mm, roughly triangular in cross section, the distal surface slightly rounded, the two proximal surfaces flat; exocarp brown, glabrous, finely granular, the bases (scars) of the two inner surfaces (where connate to adjacent nutlets) widely elliptic, ca. 0.4 mm, sordid, spongy.

Phenology. Flowering begins in late April, peaking in late May to early June.

Etymology. The specific name alludes to the pale yellow flowers. In anticipation that the species will be assigned a common name, we are suggesting that it be called "yellow flowered beebalm."

Paratypes. [In the following list of paratypes, the acronym ETNC is used for the herbarium at Jarvis College, Hawkins, Texas. This acronym is not from Index Herbariorum nor is it used to designate any other herbarium.] **TEXAS**. **Cass Co.**: Tex. Hwy 49, south of Avinger off road near airport, 16 May 2001, *Holmes & Singhurst 11534* (BAYLU); Buzzard's Roost Mountain, on FM 729 near Lone Star, 16 May 2001, *Holmes & Singhurst 11539* (BAYLU); 0.6 mile south of jct. of County Road 4125 and Tex Hwy 43, 24 May 2006, *Holmes & Singhurst 13620* (BAYLU). **Marion Co.**: north side of Lake o' the Pines on County Road 2316, south of Rock Island, 12 May 1999, *Holmes & Singhurst 9962* (BAYLU, NLU). **Morris Co.**: Daingerfield State Park, 16 May 2001, *Holmes & Singhurst 11509* (BAYLU). **Upshur Co.**: Tex. Hwy 155, 0.4 mile W of jct. with FM 555, ca. 6 miles NE of Gilmer, 16 May 2001, *Holmes & Singhurst 11544* (BAYLU). **Wood Co.**: sandy pasture and edge of post oak woods ca. 4 mi. E of Lindale, 7 May 1991, *R. Kral 78614* (NLU); Hainesville, 4 mi. NW on CR 3250 × CR3256, 3 Jul 2011, *W. Godwin, M. Godwin, & C. Goodwin 135* (BAYLU, ETNC); Mineola, 4 mi. E Palmer Spring on CR 2650, 30 Jul 20100, *W. Godwin & D. MacBurnett 123* (BAYLU, ETNC); Hainesville, 4 mi. NW on CR 3250 × 3256, 9 Jul 2011, *W. Godwin 122*

(BAYLU, ETNC); Hainesville, 4 mi. S on Salesmanship Club, on gravelly Weches hills, 30 Apr 2011, *W. Godwin 121* (BAYLU, ETNC). **ARKANSAS. Miller Co.**: County Road 32, 0.1 mile E of jct with County Road 107 near Brightstar, 24 May 2006, *Holmes & Singhurst 13620* (BAYLU); County Road 107, 0.7 mile S of jct with Ark. Hwy 160 near Brightstar, 24 May 2006, *Holmes & Singhurst 13628* (BAYLU).

Monarda luteola is characterized by pale yellow flowers (10Y 9/8.5 /4 – 10Y 8.5/9 /4 as determined by comparison with the color plates of the Munsell Book of Color Glossy Collection (undated). The color is present in fresh corollas of all ages and does persist in pressed and dried materials if correctly prepared. Unfortunately, the flower color is unfailingly reported as "white" on specimen labels, thus the new species has long been treated as being *M. lindheimeri*, a species too widely interpreted so as to include the overwhelming majority of "white" flowered *Monarda* of east Texas. The qualitative nature of the protologue of *M. lindheimeri* can only be interpreted by reference to the types (*Lindheimer 151*), the holotype of which is said to be at GH (Turner 1994). Even though GH has two specimens of *Lindheimer 151*, it is safe to say that the holotype is barcoded 00001333), since the other specimen (barcode 00001334) was transferred from the Boston Society of Natural History to GH in October 1941. Two isotypes are housed at the Missouri Botanical Garden. While *Monarda luteola* and *M. lindheimeri* can be distinguished by flower color (pale yellow vs. "white") when in the fresh condition, it is possible that the flowers of *M. lindheimeri* may be pale yellow, but misreported, as is the case with *M. luteola*. No evidence of yellow flowers appears present in the preserved material of *M. lindheimeri* that we have studied. The two species, however, can be distinguished by use of the following key that was written for herbarium specimens. The key also serves to define our interpretation of the salient characteristics of *M. lindheimeri*.

1. Leaves ovate to ovate-deltate, shorter than internodes, 3–6 × 1.8–3.6 cm [$\bar{x}$ = 4.4 × 2.4 cm, n = 21], bases subcordate to cordate, secondary nerves are insertion of petiole retrorsely curved, blade surfaces hispid-hirsute and additionally densely shrouded with a fine puberulence (visible with lens); calyx finely puberulent, glandular hairs few or lacking ..... **Monarda lindheimeri**

1. Leaves lanceoate to lanceolate-triangular, usually as long or longer than internodes, 4.3–8.4 × 2.3–3.7 cm [$\bar{x}$ = 6.9 × 3 cm, n = 12], bases rounded-truncate to sometimes vaguely subcordate, secondary nerves at insertion of petiole antrorsely disposed, surfaces hispid-hirsute, fine puberulence lacking; calyx with glandular hairs ..... **Monarda luteola**

Other items that distinguish the species include odor and distribution. *Monarda luteola* has a strong scent of lemon (similar to *Hedeoma reverchonii* (A. Gray) A. Gray or *H. drummondii* Benth.). *Monarda lindheimeri* has a scent similar to *M. fistulosa* or *M. russelliana*, which may be described as a distinctly pungent gasoline-like odor, not at all pleasant. The distribution of *M. luteola* is confined to the Weches Geologic Formation of northeast Texas and adjacent Miller County, Arkansas. This is an area of red clay acidic soils on exposed iron ore ridges. *Monarda lindheimeri* is distributed in circumneutral soils of the lower part of the Gulf coastal plain from southwest Louisiana to Gonzales County, Texas. The two species are allopatric in distribution.

Pollinators: The following two insects were the most prominent pollinators of *Monarda luteola* at the time of collection of the type. (1) **bumblebee**, *Bombus* (probably), Hymenoptera, Apidae and (20 **skipper**, Lepidoptera, Hesperiidae.

IUCN Red List Category. The species is widespread and abundant within its distribution area and is considered to be of least concern (LC).

Figure 1. Holotype of *Monarda luteola* (*Holmes and Singhurst 14012*, BAYLU). Photograph by Darrell Vodopich.

Monarda luteola is amply abundant in Texas and of no conservation concern. In 2006, a total of 102 genets were located by Holmes and Singhurst (2007) in Miller County, Arkansas, all within one square mile (~2.6 sq. km). The genets were concentrated in three populations near the community of Brightstar. The area appeared to be a low quality pine plantation and may be subject to logging activities. The species should be of conservation concern within that state.

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NEW EXOTIC ADDITIONS AND OTHER NOTEWORTHY RECORDS FOR THE FLORA OF NORTH CAROLINA

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ABSTRACT

Thirty exotic taxa are reported from northwestern North Carolina. These taxa are either new additions to the vascular flora of the state, provide voucher substantiation for reports in Weakley (2011), or supply additional occurrence records for taxa rarely attributed to North Carolina.

Floristic research continues to provide updated records and fill distribution gaps for vascular plant taxa within the southeastern United States (Hartman & Nelson 1998; Ertter 2000). This work is a direct effort of a broad community of botanists that thrive upon the promulgation of botanical information and discovery. The significance of such field research is the detection of novel additions to a floristic region, which subsequently improve our understanding of plant biogeography, species diversity, and heighten awareness of the potential for exotic invasion.

Weakley (2011) has provided the latest installment documenting the flora of the southern and Mid-Atlantic U.S. The nature of this work is dynamic and has progressively evolved both in geographic scope and taxonomic breadth to accommodate the tremendous number of taxa that were not treated by previous works (e.g., *Manual of the Vascular Flora of the Carolinas* [Radford et al. 1968]). This floristic treatment is broadly inclusive in nature and subsequently recognizes the presence of adventive, persistent, and clearly naturalized taxa (the former two of which are often excluded from traditional regional floras). Likewise, this work has been revised on a near annual basis since 2005 and made available online "free of cost" in an effort to attain the utmost accuracy in representing the plant life of this region. This revision of the known taxa for the southern and Mid-Atlantic United States is an enormous task that has resulted in a large number of noteworthy collections papers, such as the one presented here, over the last half century (e.g. Leonard 1971; Pittillo & Brown 1988).

Because of the extensive additional botanical exploration that has occurred in the region since the publication of the landmark *Manual of the Vascular Flora of the Carolinas* (Radford et al. 1968), changing criteria relative to the inclusion of alien species (see next paragraph), and changing taxonomic opinions, about 1200 additional taxa are recognized for the Carolinas, an increase of nearly one third in the documented flora of the two-state region. Most of this increase represents newly documented and established alien species but also represents over 300 native species found to be a component of the two-state flora and over 100 newly described species (Weakley 2005; Weakley 2011).

There is a tendency to avoid mention of aliens in floras and in "new records" papers of this kind until they are demonstrably well-established and widespread. Some floras have used a "minimum number of counties" criterion for the inclusion of aliens. But invasive aliens that can cause significant ecological and economic damage are best managed when their discovery is documented and publicized early on in their establishment process and when means to identify them are provided in local and regional floras so that the discovery and recognition of other populations is facilitated. Pyšek et al. (2004) and others have emphasized that the very inconsistent inclusion of alien species in floras, and the lack of standardized criteria and terminology to describe the degree of their establishment, complicates many kinds of studies as well as conservation management. Here we try to convey the status of the alien species reported (as best it can be determined based on the information currently available to us) and to provide documentation that supports their inclusion in some manner in future floras.

As a direct result of the ongoing studies of vascular plant diversity in the Southern Appalachians (with a current emphasis on the plants of Alleghany County, NC, by the first author), we here acknowledge the presence of several new additions and multiple updated distributional records to North Carolina's flora from the northwest portion of the state.

The status of each exotic taxon (i.e., naturalized, adventive, or uncertain) is noted, with apparent first vouchered reports, including specimens (as signified by an asterisk [*]) substantiating attribution in Weakley (2011). We are defining these exotic categories, modified from Nesom (2000), as follows: "naturalized" = a population of plants that appear to be inadvertently introduced into the flora and well-established (i.e., persistent for several seasons) and "adventive" = a waif or sporadic introduction (usually a single individual or limited number of plants) that is doubtfully capable of sustaining itself for more than one season. Plants that are merely persistent from local cultivation and thus not showing signs of escape or migration are not considered here. For the sake of brevity, voucher specimen citations include only the primary collector.

APIACEAE

***1. Anthriscus sylvestris** (L.) Hoffm. subsp. **sylvestris** – This European native, commonly referred to as Wild Chervil, has endured a convoluted history in North Carolina, first being misidentified as *Conioselmum chinense* (L.) Britton, Sterns, & Poggenb. (Mellichamp et al. 1987) and then correctly verified based on further examination (Mellichamp et al. 1988). However, the authors admitted to the ambiguity of the collection locality at Roan Mountain (Carver's Gap) and suspected that the plant was present in both Tennessee and North Carolina. The population from which their collections were made is located entirely within Tennessee, so no specimens have been accurately attributed to North Carolina. Voucher specimens are here documented from Alleghany, Ashe, and Watauga counties, which provide a source for the North Carolina attribution in Weakley (2011). Each population of this biennial taxon was clearly established at its respective locality.

Voucher specimens: **Alleghany Co.**: Laurel Springs. Located along NC Hwy 18 S ca. 100 m from Pine Fork Baptist Church, near jct. w/ Dixon Rd. Growing in wet roadside ditch, under a large rock outcrop. Ruderal/culturally disturbed habitat. 30 + individuals. 36°26.601'N, 81°13.029'W, elev. 924 m. 21 May 2008, *D.B. Poindexter 08-217* (BOON, NCU). **Ashe Co.**: Fleetwood. Located along US 221 traveling south, at the jct. with Mulatto Mountain Rd. (SR 1145). Growing along the roadside. 4-5 individuals. 36°18'17.5"N, 81°30'19.7"W, elev. 899 m. 30 May 2008, *D.B. Poindexter 08-235* (BOON, NCU). **Watauga Co.**: North of Boone. Located along Howards Creek Rd. (SR 1306), ca. 85 m north of the jct. with Curley Maple Rd. (SR 1323). Growing along a mesic, roadside embankment. 15-20 individuals. 36°16'22.3"N, 81°42'56.8"W, elev. 1183 m. 30 May 2008, *D.B. Poindexter 08-227* (BOON, NCU).

***2. Heracleum mantegazzianum** Sommier & Levier – Giant Hogweed is a native of Eurasia, with a biennial or monocarpic perennial growth duration. It is an extremely robust herb, often attaining heights of 5 m or more. Sap of this species contains phytotoxic furocoumarins that can cause dermatitis and blindness in susceptible individuals (Jahodová et al. 2007). In North America, its current naturalized distribution is confined to the northernmost states and provinces, reaching its southernmost limit in New Jersey. This record for North Carolina is a new range extension for this taxon, but only a single individual was observed and thus Giant Hogweed is perhaps best treated as adventive. Since this species is a federally listed "noxious weed" (USDA, NRCS 2011) it has high management priority in the state. Consequently, the plant was recently removed by the North Carolina Department of Agriculture (Rick Iverson, pers. comm.), but it will require annual monitoring to make sure that the seed bank is not viable and the plant is fully eradicated.

Voucher specimens: **Watauga Co.**: near Blowing Rock. Located along Edmisten Rd., near the Blue Ridge Parkway, at the jct. with US 321. Growing in a drainage ditch 50 m N of the jct. Rare (a single individual observed), ca. 2-3 m tall, rays of central umbel 86. Exotic, robust biennial/monocarpic perennial herb. 36°9'1.69"N, 81°39'37.09"W, elev. 1055 m. 4 August 2011, *D.B. Poindexter 11-133* (BOON).

ASTERACEAE

The three taxa of *Centaurea* documented below are found at nearby stations in Virginia (Wieboldt et al. 2011) and are perhaps derived from those populations. All three taxa listed here were clearly naturalized. Likewise, the collections of *Centaurea jacea* and *C. ×moncktonii* currently represent the most southern stations (within the southeastern USA) known to the authors for these two taxa. Based on the regularity with which these three entities are appearing in the mountains of North Carolina, we can predict with some confidence that additional species within this complex (e.g., *Centaurea nigra* L.) will soon be discovered within the state.

***3. Centaurea jacea** L. – Brown Knapweed is a perennial European native that thrives in open disturbed areas, particularly along roadsides. This plant was accounted for in North Carolina by Weakley (2011) and basis for this documentation is provided below. This plant (along with the following two taxa within the same genus) will undoubtedly become more common in the state with continued anthropogenic activity.

Voucher specimens: **Alleghany Co.**: Gap Civil Township, Sparta. Located at the jct. of Bledsoe Rd. and US 21 northwest of Sparta and across from the County Fairgrounds/Emerson Black Building. Growing in gravelly soils in a parking area at the jct. Occasional, exotic perennial forb/herb. 36°31'3.23"N, 81°8'43.28"W, elev. 903 m. 3 September 2008, *D.B. Poindexter 08-1114* (BOON), Located off of US Hwy 21, north of Sparta at G & B Oil. Naturalized in yard and along the roadside.

Occasional, exotic perennial forb/herb. 36°30'53.9"N, 81°8'9.4"W, elev. 893 m. 23 August 2008, *D.B. Poindexter 08-965* (BOON, NCU); Prathers Creek Township, Scottville. Located along US 221, at Bruner Sides Farm, ca. 0.2 mi east of the NC 113 jct. Growing along roadside drainage area. Scarce, exotic perennial forb/herb. 36°29'3.8"N, 81°16'47.7"W, elev. 877 m. 28 August 2008, *D.B. Poindexter 08-992* (BOON).

***4. Centaurea nigrescens** Willd. – Tyrol Knapweed is currently known from a single locality in Alleghany County. This perennial European native is well-established at this site and consists of approximately 50-100 individuals. Like its sister taxa, it prefers disturbed roadsides and field margins. This species is rapidly increasing in abundance in the northern Piedmont of Virginia (Weakley 2011) and its discovery in North Carolina is not surprising considering its rate of expansion. Tyrol Knapweed is also known from Tennessee (Chester et al. 2009), and has apparently been collected in Florida (Keil & Ochsmann 2006).

Voucher specimens: **Alleghany Co.:** Prathers Creek Township, Peden. Located along Weaver Rd. (SR 1302). Growing in disturbed roadside habitat, ca. 0.4 mile from the jct. with Topia Rd. (SR 1303). Growing in culturally disturbed, ruderal habitats bordering the road. Infrequent, exotic perennial forb/herb. 36°29'52.60"N, 81°19'0.06"W, elev. 778 m. 19 August 2009, *D.B. Poindexter 09-942* (BOON); same locality, 28 August 2009, *D.B. Poindexter 09-1007* (BOON); 15 September 2010, *D.B. Poindexter 10-485* (NCU).

***5. Centaurea ×moncktonii** C.E. Britton – Of the three sister taxa documented in this report, Meadow Knapweed has been the most frequently encountered by the first author. It is a fertile perennial of introgressive origin involving members of the *Centaurea jacea* species complex. This hybrid is ostensibly derived from the parent species *Centaurea jacea* and *C. nigra* L. with possible genetic influence from other species including *C. nigrescens* (Keil & Ochsmann 2006).

Voucher specimens: **Alleghany Co.:** Cranberry Township, Laurel Springs. Located along Elk Knob Rd. (SR 1143), ca. 0.5 mi south of the NC 18/NC 113 jct. Growing in a culturally disturbed roadside habitat, on the east side of the road. Infrequent, exotic perennial forb/herb. 36°25'3.6"N, 81°14'50.5"W, elev. 873 m. 28 August 2009, *D.B. Poindexter 09-1002* (BOON, NCU). **Ashe Co.:** Fleetwood. Located along US 221, ca. 0.65 km north of Twin Bridges Dr. Growing in field-like roadside near the South Fork of the New River. Scarce. 36°17'44.99"N, 81°29'53.28"W, elev. 876 m. 28 August 2009, *D.B. Poindexter 09-1019* (BOON, NCU).

BETULACEAE

***6. Betula pendula** Roth – European White Birch is a striking tree with bright white bark, commonly found as an ornamental species in the southeastern United States. It has been documented in nearby localities in Virginia (Wieboldt et al. 2011). In Alleghany County, this tree was found escaped in an abandoned and overgrown lot. The few small saplings that were present at this site have recently been destroyed for apparent urban development. The Watauga County population is thriving along a very steep road cut, where the bases of small trees are enveloping exposed rocks. The sporadic spacing of individuals and shallow soils inhabited by these trees indicate that they are clearly naturalized and not intentionally planted.

Voucher specimens: **Alleghany Co.:** Gap Civil Township, Sparta. Located at the jct. of Ballpark Rd. and Estep St. A couple of small saplings present, growing in an abandoned lot. Rare, exotic tree. 36°29'56.07"N, 81° 6'49.62"W, elev. 876 m. 8 June 2009, *D.B. Poindexter 09-504* (BOON, NCU). **Watauga Co.:** Deep Gap. Located along US Hwy 421 S, near jct. with Orchard Rd. (SR 1362).

About 10-15 saplings to small trees were observed growing in thin, rocky soils and on outcrops of a road cut embankment. 36°13.312'N, 81° 29.031'W. 29 April 2007, *D.B. Poindexter 07-99* (BOON, NCU).

CAMPANULACEAE

7. Campanula rapunculoides L. – The only previously known collection of Rampion Bellflower from North Carolina is from a Watauga County specimen (1 August 1954, *Brown & Brandon s.n.*, BOON) annotated by H. E. Ahles in 1964. Locality data on the label was vague, consisting of "roadsides, meadows." This record was presumably used as the sole voucher for *C. rapunculoides* in Radford et al. (1968). Here we provide additional records to corroborate the naturalized occurrence of this perennial species in the state. This species is often cultivated for its large, showy blue flowers. It is well-documented to the north in Virginia, particularly in montane counties (Wieboldt et al. 2011) and is also attributed to Tennessee (Chester et al. 2009).

Voucher specimens: **Alleghany Co.:** Glade Creek Township, Edmonds. Located along Glade Valley Rd. (SR 1444), 65 m south of the NC 18 jct. Growing on a roadside embankment, on the west side of SR 1444. Not growing in an obviously planted area, appearing to be adventive or escaping from nearby cultivated populations. Rare, exotic perennial forb/herb. 36°33'26.6"N, 80°56'7.6"W, elev. 869 m. 16 June 2009, *D.B. Poindexter 09-578* (BOON). **Avery Co.:** Roseborough. Located along Roseboro Rd. traveling south, ca. 0.3 mi past Grassy Prong Rd. (FR 192) and ca. 0.6 mi prior to Rockhouse Creek Rd. (FR 451). Growing in a disturbed ditch line on the right-hand side of the road. 36°1.935'N, 81°47.978'W. 2 July 2007, *D.B. Poindexter 07-326* (BOON).

CARYOPHYLLACEAE

8. Sagina procumbens L. – Northern Pearlwort is a species of perennial plants native to Eurasia and presumably boreal North America, although questionably so (Weakley 2011). Occurrences of this taxon in the southeastern USA are traditionally treated as introductions. According to Weakley (2011), this species has only been collected in North Carolina once, from a gravel parking lot at Roan Mountain (Mitchell County) and was assumed to be an adventive introduction. Below we cite an additional collection from Alleghany County that was found in an area of heavy disturbance (crevices of a brick walkway). It is very doubtful that the property owners intentionally planted this species, and its abundance and perennial nature suggest that it has been established at this old homesite for an indefinite period of time. Thus we are interpreting this record as a naturalized population at this site.

Voucher specimens: **Alleghany Co.:** Located along Prathers Creek Church Rd. (SR 1163B) at address 1547, ca. 0.95 mi northeast of the Doughton Mountain Rd. (SR 1149) jct. Growing in cracks of a brick walkway in front of an old farmhouse. Infrequent. 36°28'30.3"N, 81°14'14.2"W, elev. 1022 m. 5 August 2010, *D.B. Poindexter 10-442*(BOON, NCU).

CHENOPODIACEAE (now included in the AMARANTHACEAE)

***9. Bassia scoparia** (L.) A.J. Scott – This annual Eurasian native is most commonly found in waste areas, usually as a mere waif in the southeastern USA (Weakley 2011). Commonly referred to as Summer-cypress, this exotic has been documented with regularity in Virginia (Wieboldt et al. 2011) and is also attributed to the flora of Tennessee. A single record is known from North Carolina based on a collection from Davidson County (5 November 1946, *O.F. McCrary s.n.*, NCSC). The exotic status of this collection is unclear due to the lack of an explicit statement regarding the nature of its occurrence.

The specimen cited below was clearly from an adventive population, but it should be noted that these plants were producing mature fruit. This species, as well as several others discussed below, are often attributed to ballast, wool-mills, bird seed contaminate, or similar situations that are primarily affected by industrial practices (i.e., the importation of plant materials for feed). The potential for feed impurities, or even exotic seed itself, to produce species that sparingly naturalize in a region due to human practices is not uncommon. Several of the plants listed within this report as bird seed waifs have been likewise documented in Great Britain and are known to "casually" naturalize (Hanson & Mason 1985).

> Voucher specimens: **Ashe Co.:** West Jefferson. Located at the Z. E. Murrell residence, 1011 Calloway Gap Rd. This taxon is within the "*scoparia* complex" and exhibits an excessive villous pubescence similar to material referred to as var. *subvillosa*. Waif growing under a bird feeder. 36°17'37.70"N, 81°22'51.02"W, elev. 917 m. 22 August 2007, *D.B. Poindexter 07-707* (BOON).

***10. Dysphania pumilio** (R. Brown) Mosyakin & Clemants – This annual species, commonly known as Clammy Goosefoot, is becoming an increasingly common weed of disturbed areas in Virginia and is expected to expand its naturalized range. Weakley (2011) reports a current known distribution in the eastern USA of Piedmont areas extending from the District of Columbia to Georgia, with the exception of North Carolina. The population documented here is not confidently deemed "naturalized" and should perhaps be treated as merely adventive until additional populations are discovered.

> Voucher specimens: **Ashe Co.:** Growing around perimeter of a vegetable garden. Apparently introduced as seed contaminant, but proliferating in disturbed areas near the area of cultivation. 36°16'16.89"N, 81°31'48.70"W, elev. 963 m. 23 June 2010, *D.B. Poindexter 10-367* (BOON, NCU).

HYACINTHACEAE

***11. Chionodoxa luciliae** Boiss. – Glory-of-the-snow is a species of perennial plants native to western Turkey and widely cultivated in the USA (McNeill 2002a). Although sparingly documented from a few northern states, McNeill (2002a) suggests that it is likely to escape elsewhere, noting "lawns" as the typical naturalized habitat. This plant was found near areas of cultivation but growing in adjacent lawn areas in Alleghany County, intercalated with denser areas of grass. Considering the small population size and habitat, this species is probably best treated as adventive.

> Voucher specimens: **Alleghany Co.:** Gap Civil Township, Sparta. Located along Cherry Street where the road makes a 90 degree turn, at a house adjacent to (south of) Dr. Terry Johnson's dental office. Growing in the residential lawn, escaped from nearby cultivation. Scarce (but several flowering and non-flowering plants noted), exotic perennial herb. 36°30'30.74"N, 81°6'57.84"W, elev. 893 m. 31 March 2011, *D.B. Poindexter 11-06* (BOON).

***12. Hyacinthoides × massartiana** Geerinck (syn. **Hyacinthoides ×variabilis** P. D. Sell) – The Hybrid Bluebell is a fertile perennial, derived from *Hyacinthoides hispanica* (Mill.) Rothm. (Spanish Bluebell) and *H. non-scripta* (L.) Chouard ex Rothm. (English Bluebell). As their colloquial names suggest, both parents are natives of Europe but are geographically disparate and isolated. In Great Britain, recent attention has been focused on the negative impacts of hybridization on the native English Bluebell populations (Kohn et al. 2009). Due to regular cultivation of the Spanish Bluebell in Great Britain, risks of assimilation are great. Rix (2004) noted that the Hybrid Bluebell was not only often sold under the alias of "Spanish Bluebell" but is a rather aggressive weeds due to its vegetative and sexual modes of reproduction. Rix (2004) also provided a detailed description and illustrations of

both rather delicate parents as well as the more robust hybrid (intermediate but larger, perhaps due to hybrid vigor). McNeill (2002b) indicated that the hybrid is regularly cultivated in the USA and well-established in Washington and also suggested that the hybrid is probably established elsewhere. Owing to likely confusion with its parents, its use in the nursery trade, as well as its fertile nature (often occurring without either parent), Hybrid Bluebell is very likely to be much more common than voucher specimen records suggest.

> Voucher specimens: **Alleghany Co.:** Cranberry Township, Laurel Springs. Located along the Blue Ridge Parkway, 0.15 mi east of NC 18. Growing along the banks of Meadow Fork Creek, under shrubs in alluvial soil (ca. 20 m north of the road). Definitely not cultivated. Rare, exotic perennial forb/herb. 36°23'28.8"N, 81°14'34.6"W, elev. 865 m. 1 May 2009, *D.B. Poindexter 09-132* (BOON)

LAMIACEAE

***13. Clerodendrum trichotomum** Thunb. var. **ferrugineum** Nakai – This small tree, native to east Asia, has been attributed to North Carolina based on the several sources (Kartesz 2011; USDA, NRCS 2011). This record for the state is derived from Moldenke (1980) for Surry County. It is unclear based on this publication whether the author was referencing physical voucher specimens (none are known to the authors), site records of naturalized populations, or simply cultivated populations. Weakley (2011) attributed this plant to North Carolina (see documentation below). This plant (formerly placed within the Verbenaceae) is very attractive and presumably entered the regional flora through the nursery trade. Harlequin Glory-bower has been collected from legitimately naturalized colonies in Ashe and Wilkes County. It seems to prefer disturbed riparian areas and is showing up with greater regularity, which suggests that this taxon is increasing in its invasiveness, particularly in the mountains and adjacent foothills of North Carolina.

> Voucher specimens: **Ashe Co.:** Jefferson. Located along NC 16 N, 0.8 mi north of the US 88 jct. and ca. 0.5 mi south of the US 221 jct. Growing on the west side of the road in a culturally disturbed habitat above a small stream. Infrequent (12 individuals), exotic small tree. 36°25'44.57"N, 81°26'25.80"W, elev. 894 m. 3 October 2010, *D.B. Poindexter 10-488* (BOON, NCU). **Wilkes Co.:** Along South Fork of Reddies River, Vicinity of Wilbar, along NC 16, for several miles. Habitat: roadsides and streambanks. 29 September 2002, *A.S. Weakley 7201* (NCU).

***14. Prunella aff. laciniata** (L.) L. – Cutleaf Self-heal is a perennial, Eurasian native that was attributed to North Carolina by Radford et al. (1968). Interestingly, this record was admittedly based on no known voucher specimens. Below we provide documentation of a similar taxon from a mixed population containing the sister species *Prunella vulgaris* L. in a shady, disturbed site in Alleghany County. The precise determination of this specimen is somewhat problematic. It only differs morphologically from *P. vulgaris* in the presence of obvious lobed-pinnatifid leaves, which are characteristic of *P. laciniata*. Otherwise, pubescence is very thin and leaf venation patterns are more characteristic of *P. vulgaris*. It is possible that this voucher represents either a teratological morphotype or perhaps a hybrid introduction of *P. x intermedia* Link (= *P. laciniata x P. vulgaris*). Šegota et al. (2009) have enumerated the various differences in hybrids within the genus, but due to morphological plasticity, an unequivocal determination cannot be made. Ultimately, material such as this could have been responsible for the early, unsubstantiated report of *P. laciniata* in North Carolina. This taxon was quite rare at this site, consisting of only six observed individuals.

Voucher specimens: **Alleghany Co.**: Gap Civil Township, Twin Oaks. Located off of Nile Rd. (SR 1405) traveling east, at a logging road entrance on the right just prior to Dirt Nose Dr. This site is the Reeves' Property. Growing in semi-disturbed woodland margin adjacent to stream. Rare, exotic perennial forb/herb. 36°33'24.80"N, 81° 8'1.70"W, elev. 753 m. 22 July 2009, *D.B. Poindexter 09-833* (BOON).

MALVACEAE

15. Anoda cristata (L.) Schlecht. – This annual species is native to the southwestern USA as well as Central and South America (Weakley 2011). Spurred Anoda has only been documented from North Carolina based on a single collection from Mecklenburg County (2 October 1958, *H.E. Ahles 50200*, NCU) and was included in Radford et al. (1968). This taxon was found at a "waste ground" site in Charlotte according to the label data. In Ashe County, this plant was one of the three adventive species documented as derived from bird seed waste. Interestingly, this is one of the species noted by Hanson & Mason (1985) as a sporadic bird seed alien in Great Britain. *Anoda cristata* has also been documented from multiple counties in the Piedmont and Coastal Plain of Virginia (Wieboldt et al. 2011).

Voucher specimens: **Ashe Co.**: West Jefferson. Located at the Z. E. Murrell residence, 1011 Calloway Gap Rd. This plant was found as a waif, growing under a bird feeder in the front yard. 36°17'37.70"N, 81°22'51.02"W, elev. 917 m. 19 September 2007, *D.B. Poindexter 07-780* (BOON).

PAPAVERACEAE

***16. Macleaya cordata** (Willd.) R. Brown – Plume-poppy is a perennial native of east Asia and often cultivated. It has been sparingly attributed to the flora of Virginia (Wieboldt et al. 2011) and reported as naturalized by Kral (1981) in Tennessee. In North Carolina it has been attributed to the mountains as a rare persistent or escaped species (Weakley 2011). Basis for this documentation is provided below. The collection listed from Watauga County was from a rather small but almost certainly escaped/sparingly naturalized population inhabiting an overgrown, disturbed roadside margin. No exhaustive searches were made for the cultivated source for this population.

Voucher specimens: **Jackson Co.**: well established on banks of lake at High Hampton inn, Cashiers. 22 August 1981, *C.R. Bell s.n.* (NCU). **Watauga Co.**: Valle Crucis. Located along NC 194, ca. 0.8 mi sw of the Broadstone Rd. jct. Across from the Taylor House Inn. Growing along a disturbed roadside, next to a power line pole. Rare. 36°11'56.14"N, 81°47'5.34"W, elev. 829 m. 17 July 2009, *D.B. Poindexter 09-821* (BOON, NCU).

PLANTAGINACEAE

***17. Digitalis grandiflora** Mill. – This biennial (or occasionally perennial) species, commonly referred to as Yellow Foxglove, has been documented from several northern boreal areas of North America (Kartesz 2011; USDA, NRCS 2011). This species is a Eurasian native that is rarely cultivated in North Carolina and has never been documented for the flora. In Alleghany County, it was found in a small, apparently naturalized population in the floodplain and adjacent embankment of a large reservoir.

Voucher specimens: **Alleghany Co.**: Cherry Lane Township, Roaring Gap. Located within the main property of Roaring Gap Club, northeast of US Hwy 21, along the crest of the Blue Ridge Escarpment. Found along the southern extension of Lake Louise, at the dam crossed by Roaring Gap Dr. (SR 1478) near the club entrance. Growing in the flood plain on the south side of the road. 36°23'52.07"N, 80°58'58.10"W, elev. 879. 4 June 2010, *D.B. Poindexter 10-306* (BOON).

***18. Linaria maroccana** Hook. f. – Moroccan Toadflax is an annual, native to northern Africa. It has been documented from Virginia, presumably as a waif (Weakley 2011; Wieboldt et al. 2011). In Alleghany County, a single individual was found in a dry field near Roaring Gap. This record most certainly represents an adventive introduction, as no other individuals were found the following season. Like other showy members of the genus, *Linaria maroccana* is likely to appear sporadically within our flora due to its regular cultivation.

Voucher specimens: **Alleghany Co.**: Cherry Lane Township, Roaring Gap. Located along US 21 S, ca. 0.1 mi prior to Olde Beau Blvd., at High Meadows Restaurant. Growing on the edge of a dry, sterile old field in the southeast corner of the parking lot. Rare, exotic annual forb/herb. 36°24'25.4"N, 80°59'31.1"W, elev. 852 m. 10 September 2008, *D.B. Poindexter 08-1232* (BOON).

19. Veronica chamaedrys L. – This Eurasian native, commonly referred to as Germander Speedwell, is a perennial species that is more common than the literature indicates (Radford et al. 1968; Weakley 2011). Radford et al. (1968) presumably based their documentation on a specimen that was collected in Jackson County, within the southwestern mountains of North Carolina (16 May 1964, *W.C. Grimm s.n.*, NCU). However, additional specimens were collected as early as 1970 from the northwest mountains. In addition, this species was documented by Livengood (1972) along the Blue Ridge Parkway (a unit of the National Park Service) in Watauga County. Based on the specimen record, Germander Speedwell continues to persist along the Blue Ridge Parkway, where roadside mowing efforts have likely disseminated seeds of this species.

Voucher specimens: **Alleghany Co.**: Cranberry Township, Laurel Springs. Located at the on-ramp jct. of NC 18 and the Blue Ridge Parkway, 0.1 m east of NC 18. Growing under a shrub in the median of the jct. Frequent, exotic perennial forb/herb. 36°23'28.43"N, 81°14'36.99"W, elev. 866 m. 1 May 2009, *D.B. Poindexter 09-134* (BOON). **Ashe Co.**: Fleetwood. Located at 373 Cranberry Ln. Well- established/naturalized in a residential lawn. Frequent. 36°16'15.89"N, 81°31'48.78"W, elev. 957 m. 9 May 2009, *D.B. Poindexter 09-193* (BOON). **Watauga Co.**: Deep Gap on the Blue Ridge Parkway, 14 May 1970, *S. Scott 50* (BOON), Sim's Pond, roadside of Blue Ridge Parkway near bridge, 16 May 1971, *J.M. Carr s.n.* (BOON), same location, 18 May 1971, *M. Livengood 33* (BOON), SE of Foscoe. Located along the Blue Ridge Parkway, 0.5 mi W of Price Lake. Growing along mowed roadside and in forest ecotone. Frequent, exotic perennial herb/forb, 36°8'0.5"N, 81°44'34.4"W, elev. 1056 m. 19 May 2011, *D.B. Poindexter 11-105* (BOON).

POACEAE

***20. Arrhenatherum elatius** (L.) J. Presl & C. Presl var. **bulbosum** (Willd.) Spenn. – The typical variety of this species is a rather common constituent of meadows, fields, and roadsides in the state. The variety reported here, *Arrhenatherum elatius* var. *bulbosum*, has not yet been attributed to our flora. Tuber Oatgrass is a perennial native of Europe that was cultivated for its moniliform tubers during the Bronze Age (Weakley 2011). Typical Tall Oatgrass lacks tubers and derives its perennial habit from a cormose base. Specimens cited here from Watauga County are not heavily naturalized. Additional plants have been observed from this county at the Appalachian State University Farm, where they have been inadvertently introduced into cultivated fields.

Voucher specimens: **Watauga Co.**: Valle Crucis: Located along Red Tailed Hawk Rd., first residence on the left just west of the Dewitt Barnett Rd. jct. (ca. 0.3 mi NE of the Broadstone Rd. jct.). Growing in riparian zone of Watauga River and in adjacent cultivated areas. Infrequent. 36°12'31.61"N, 81°46'8.02"W, elev. 813 m. 17 July 2009, *D.B. Poindexter 09-823* (BOON, NCU).

***21. Eragrostis tef** (Zuccagni) Trotter – This annual, native to Africa and commonly known as Teff,, has been documented from South Carolina near wool-combing mills and currently appears to be adventive in Alleghany County. It was found in the margin of a field, where it had presumably been cultivated for fodder, with a few individuals later germinating and persisting in disturbed soils.

Voucher specimens: **Alleghany Co.:** Gap Civil Township, Twin Oaks. Located off of New Haven Rd. (SR 1403), along driveway to the Roupe residence, ca. 0.3 mi south of the divergence of Nile Rd. (SR 1405) jct. Growing in old field that is mowed for hay. Frequent, exotic annual graminoid. 36°33'12.04"N, 81° 8'33.84"W, elev. 802 m. 9 September 2009, *D.B. Poindexter 09-1042* (BOON, NCU).

***22. Glyceria declinata** Bréb. – Waxy Mannagrass is a European native that is apparently becoming ever more common in North America based on an expanding distribution noted from range maps and text of various sources (Weakley 2011; Kartesz 2011; USDA, NRCS 2011). The establishment of this species in disturbed stream areas of North Carolina is likely a consequence of the plant's perennial habit. The records cited below substantiate the occurrence information provided by Weakley (2011).

Voucher specimens: **Alleghany Co.:** Piney Creek Township, Piney Creek. Located at the Stokes Tract of the New River State Park off of Deer Valley Rd., along the east side of the New River, ca. 0.8 mi from the Virginia State Line. This site is directly across the river from the Alleghany Access of the NRSP. Growing in small stream. Occasional, exotic perennial graminoid. 2 June 2008, *D.B. Poindexter 08-243* (BOON, US). **Watauga Co.:** East of Boone along Laxon Creek, 36°14'52.58"N, 81°34'38.50"W, elev. 906 m, locally common in *Alnus/Salix* riparian community, 20 May 2008, *M.W. Denslow 2577* (BOON, NCU).

23. Hordeum jubatum L. subsp. **jubatum** – Foxtail Barley is a perennial, native to the western USA. This taxon is treated as introduced in the eastern USA, where it seems to prefer medians of larger road systems. This inherently disturbed habitat is perhaps conducive to the halophytic preference of this syanthrope, where roads are heavily salted during winter months, thus providing necessary environmental conditions for Foxtail Barley. This plant was attributed to North Carolina by Radford et al. (1968) and considered very rare. The only known specimens to the authors are from Wake County in the Piedmont. The specimens cited below provide additional distribution records that confirm its naturalized presence in mountains of North Carolina.

Voucher specimens: **Alleghany Co.:** Cherry Lane Township, Glade Valley. Located along US 21, ca. 0.3 mi southeast of the Glade Valley Rd. (SR 1444) jct. Growing in the gravel parking area of a construction company. Infrequent, exotic perennial graminoid. 36°27'56.05"N, 81°3'2.24"W, elev. 808 m. 12 June 2010, *D.B. Poindexter 10-321* (BOON, NCU). **Watauga Co.:** Boone. Located just outside (ca. 1 mi) of city limits, N on US 421, at latitude 36° 13.482' N and longitude 81° 37.247' W (3269 ft elev.). Growing along margins of median in disturbed (likely high salinity) soils. 22 August 2007, *D.B. Poindexter 06-181* (BOON).

***24. Panicum miliaceum L. subsp. miliaceum** – Broomcorn Millet in an annual species, native to Eurasia, and often cultivated as wildlife forage crop in the southeastern USA (Weakley 2011). This plant also is frequently found in greenhouse pots containing nursery plants, where it germinates with

ease (pers. obs.) as well as a bird feed waif (Hanson & Mason 1985). Documentation from North Carolina is based on sight records, with no previous specimen data known to the authors. This particular subspecies is far more widespread across the continental United States than subsp. *ruderale* (Kitagawa) Tzvelev. The collection cited below provides a voucher record and expands the distributional records for this plant in North Carolina. This population is most likely adventive.

Voucher specimens: **Alleghany Co.:** Prathers Creek Township, Stratford. Located along Walnut Branch Ch. Rd. (SR 1332), ca. 0.75 mi north of US 221 (west of Stratford). Growing between the road margin and an old barn. Rare, exotic annual graminoid. 36°30'43.8"N, 81°14'26.8"W, elev. 860 m. 5 August 2010, *D.B. Poindexter 10-444* (BOON, NCU).

***25. Pennisetum alopecuroides** (L.) Spreng. – Chinese Fountaingrass is a perennial species native to east Asia. It has been sparingly documented northward in Virginia but not in North Carolina (Weakley 2011). Although this plant is utilized in cultivation, the population documented here exemplifies its ability to escape and become established in disturbed environments. Several clearly naturalized colonies were noted from a roadside ditch in Alleghany County.

Voucher specimens: **Alleghany Co.:** Piney Creek Township, Piney Creek. Located along NC 113, 110 m north of the Len Rd. (SR 1322) jct. Growing in a culturally disturbed ditch on the east side of NC 113. This plant is obviously naturalized. Scarce, exotic perennial graminoid. 36°32'20.3"N, 81°18'2.1"W, elev. 877 m. 18 September 2009, *D.B. Poindexter 09-1135* (BOON, NCU).

***26. Puccinellia distans** (Jacq.) Parl. – This Eurasian perennial was found in the same locality as *Hordeum jubatum* in Watauga County. Commonly referred to as European Alkali Grass, it is the most widespread exotic within this genus in North America and appears to migrating along highway corridors that have saline soils from vehicular transport or additional vectors. Likewise, this route of dispersal has been documented in Great Britain (Scott & Davison 1982).

Voucher specimens: **Watauga Co.:** Boone. Located just outside of the city limits (ca. 1 mi), traveling N on US 421. Growing along the margins of highway median in disturbed (likely high salinity) soils. Approximately 12+ individuals. 36°13.482'N, 81°37.247'W, elev. 3269 ft. 15 June 2007, *D.B. Poindexter 07-213* (BOON).

***27. Setaria viridis** (L.) P. Beauv. var. **major** (Gaudin) Posp. – This annual taxon, known as Giant Green Foxtail, is native to Eurasia. According to Weakley (2011) it has not been documented in North Carolina. The population observed was moderate in size (ca. 30+ individuals) but found in areas of heavy recent disturbance. This suggests that the plant may be simply adventive due in part to its annual nature, and thus naturalization cannot be unequivocally confirmed at this time.

Voucher specimens: **Alleghany Co.:** Gap Civil Township, Twin Oaks. Located along Nile Rd., ca. 0.4 mi west of the River Rd. jct. Growing in disturbed roadside soils. Occasional, exotic annual graminoid. 36°34'4.49"N, 81° 6'44.10"W,e lev. 711 m. 9 September 2009, *D.B. Poindexter 09-1037*(BOON, NCU).

RHAMNACEAE

***28. Frangula alnus Mill.** – Glossy Buckthorn is a shrub or small tree that is listed as a Noxious Weed in several areas of the northeastern USA (USDA, NRCS 2011). At present, this plant is

apparently rare in the southeastern USA (Weakley 2011; USDA, NRCS 2011). The first collections of this species from North Carolina were collected by D. Pittillo along the Blue Ridge Parkway in Buncombe County in 1999 (D. Pittillo, pers. comm.). However, no specimens of this collecting event could be located (K. Matthews & D. Pittillo, pers. comm.). A new population of this species was discovered in Watauga County, where a plant was found growing spontaneously at the edge of a deciduous forest near a residence. The single observed individual suggests that this species is merely adventive at the moment. Accurate distribution records of this species are critical due to the impacts it may have on native vegetation (Frappier et al. 2003).

Voucher specimen: **Watauga Co.:** Northeast of Boone, Timberlane Drive growing spontaneously near residence, one plant seen. 36°14'20.04"N, 81°39'54.00"W, elev. 1017 m. 9 May 2010, *M.W. Denslow* 2659 (BOON, NCU, WCUH).

ROSACEAE

***29. Prunus tomentosa** Thunb. – Nanking Cherry is a shrub or small tree that is native to Asia. It is often cultivated and according to Weakley (2011) naturalized in Maryland and Pennsylvania. Rhoads and Block (2007) noted that the habitat for this taxon in Pennsylvania usually is a sandy area. In Alleghany County, it was found below a residential area on a very steep, unkempt road bank devoid of any other cultivated plants but dominated by various naturalized species and successional taxa. In this area where it was obviously not planted, we speculate that it was deposited by an animal (most likely an avian vector) from a seed source nearby. Although only a single individual was noted, the possibility for additional escaped plants in the vicinity is great. "Naturalized" is too strong of a word for currently describing the growth habit of this species until further escapes are found. Consequently, this record should perhaps be treated as adventive at present.

Voucher specimens: **Alleghany Co.:** Gap Civil Township, Sparta. Located near the city limits, traveling southeast on US 21 ca. 30 meters past Ballpark Rd. near the Little River. 36°29'51.77"N, 81°6'31.10"W, elev. 845 m. 25 March 2011, *D.B. Poindexter 11-05* (BOON, NCU).

ZYGOPHYLLACEAE

30. Tribulus terrestris L.– This species is an annual, native to Mediterranean Europe. Although this record of Puncture-weed (just as those of *Anoda cristata*, *Bassia scoparia*, and *Panicum miliaceum* subsp. *miliaceum*) is clearly a waif, it demonstrates the ability of the plant to germinate, reach anthesis, and fruit in an area that could be perceived as climatically unsuitable. With our dynamic global climate pattern, coupled with human influence, adventives such as this may become a more common component of our landscape. Consequently, acknowledging their presence now, despite their current ephemeral nature, will only increase awareness of their presence in the future. This taxon has been rarely found in the Coastal Plain of North Carolina. It is considered a noxious weed (USDA, NRCS 2011) that has only been documented from New Hanover County in North Carolina (Radford et al. 1968). This documentation provides a second county occurrence.

Voucher specimens: **Ashe Co.:** West Jefferson. Located at the Z.E. Murrell residence, 1011 Calloway Gap Rd. This plant was found as a waif growing under a bird feeder in the front yard. 36°17'37.70"N, 81°22'51.02"W, elev. 917 m. 22 August 2007, *D.B. Poindexter 07-708* (BOON).

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SECOND COUNTY RECORDS FOR TWO KENTUCKY ENDANGERED SPECIES, *ECHINODORUS TENELLUS* (ALISMATACEAE) AND *SCHOENOPLECTUS HALLII* (CYPERACEAE)

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ABSTRACT

Echinodorus tenellus and *Schoenoplectus hallii* are documented from Logan County, Kentucky, representing the second county of known occurrence in the state for each of these state-endangered species. As in the case of previous reports from Christian County, plants were found in an upland depression that had been flooded by excessive spring rains. Receding water in summer resulted in silt-loam flats where the species grew in abundance. The depression is mostly surrounded by cropland and flooded only in years where spring rains are excessive; otherwise the depression is in tilth.

KEY WORDS: *Echinodorus tenellus, Schoenoplectus hallii*, mudbabies, Hall's bulrush, Kentucky, Pennyroyal Plain

Echinodorus tenellus (Martius) Buchenau [*E. parvulus* Engelmann; *E. tenellus* var. *parvulus* (Engelmann) Fassett], mudbabies (Alismataceae), is a small (often only 4–8 cm in height at maturity in Kentucky) white-flowered annual often growing in mats. The species is known from scattered localities in eastern North America westward to Texas, Oklahoma, and Kansas, typically found in open sandy soils along margins of small streams or lakes (Haynes & Hellquist 2000). It is locally abundant but listed G3 (vulnerable) and either endangered, threatened, or historical in several states. In Kentucky it is S1 (critically imperiled) and endangered (Kentucky State Nature Preserves Commission 2011).

Schoenoplectus hallii (A. Gray) S.C. Smith (*Scirpus hallii* A. Gray), Hall's bulrush (Cyperaceae), is a tufted annual, mostly less than 20 cm tall at maturity in the Kentucky populations. Habitats include temporary ponds, wet places in cultivated fields, pastures, ditches, sinkholes, and prairies (Smith 2002). A recent study explored germination ecology (Baskin et al. 2003), showing that flooding, among other factors, is required for germination. A comprehensive status report (McKenzie et al. 2007) noted that within the prior 25 years, the species had been confirmed from approximately 84 sites scattered across 26 counties in 10 states. It is a G1 (critically imperiled) species and listed endangered, threatened, or historical in most states of known occurrence; it is S1 and endangered in Kentucky (Kentucky State Nature Preserves Commission 2011).

Previous observations and habitats for the two species in Kentucky.

Both species were first observed in 1983 (Chester & Souza 1984; Chester 1988) in a temporarily flooded depression in Christian County (Fig. 1) and both have appeared there during 16 of the past 29 summers. During other years (13/29, five consecutive 2003-2007), flooding did not occur or was of short duration and the depression was cultivated. The species were observed recently in four nearby Christian County sites, mostly during ornithological investigations by BLP-B. The

five sites were visited by the authors 30 July 2011, both species (Fig. 2) were present in all. Sites are on the southern Pennyroyal Plain, a karst region with numerous saucer-like depressions of <1-several ha within nearly level upland agronomic fields. When winter-spring rains are normal or above, the depressions may be flooded and as water levels drop during late spring-summer, a silt-loam flat is exposed and a few vascular plants (and a diversity of shore- and water-birds) appear. When rain is below normal, the depressions are cultivated with the surrounding fields and the rare species apparently persist in a soil seedbank.

The second Kentucky county record for both species.

This record for the two species was found by BLP-B on 14 July 2010, on private land in a depression as described above but in Logan County, about 50 km east of the Christian County sites (Fig. 1). The flooded area covered about 2 ha in spring 2011 but was reduced to 0.3 ha of shallow water on 27 July 2011. Hundreds of each species occurred in mixed stands on the resulting flats, on both sides of the bisecting, east-west and slightly elevated public road (Figs. 3 and 4).

It should be noted that such depressions are commonplace in Christian, Logan, and surrounding counties. Most are on private property, often deep within cultivated fields, and not accessible. We have visited several dozen but to date, the two rare species have been found only as noted above. Additional field work is warranted.

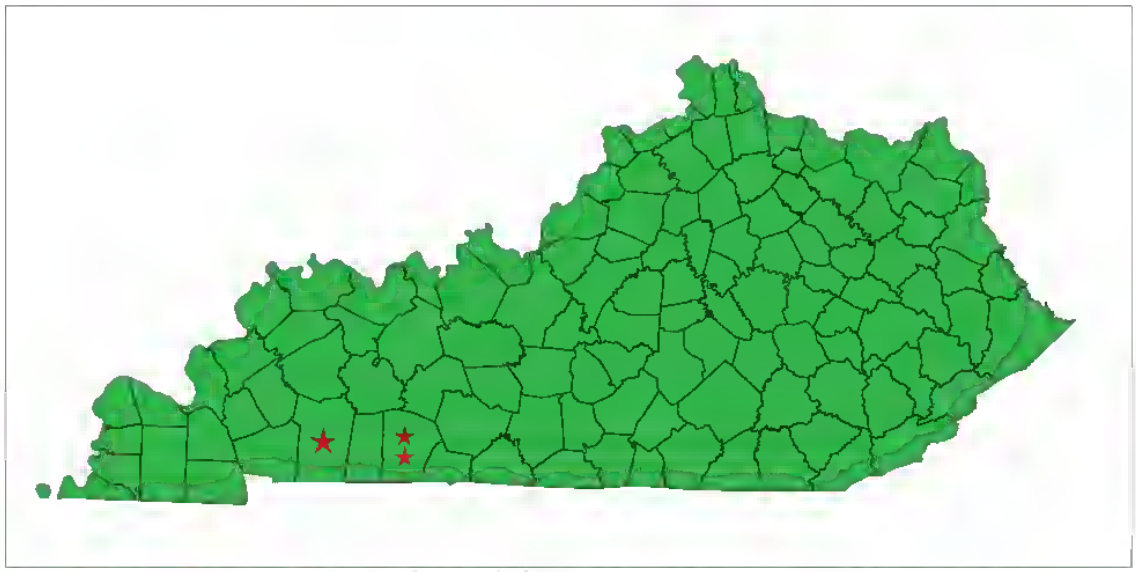

Figure 1. Map of Kentucky highlighting Christian Co. (one star) and Logan Co. (two stars).

Voucher specimens:

Kentucky. Logan Co. John Young Road (an unpaved public road) 0.8 km west of junction with KY Highway 102, northwest of Keysburg, 36.672° N, 87.033° W, extensive population in open depression in a privately owned field where flooding had occurred earlier but shallow water now covering <1/4 of the depression, 27 July 2011, *E.W. Chester 14835* [for *Echinodorus*], *E.W. Chester 14836* [for *Schoenoplectus*], with Frank Lyne. Specimens to be distributed to APSC, BRIT, EKU, TENN.

Figure 2. *Echinodorus tenellus* (flowering plants <8 cm in height) and *Schoenoplectus hallii*, Logan County, Kentucky.

Figure 3. Temporarily flooded depression in Logan County, south side of John Young Road, with mats of *Echinodorus tenellus* (mostly) in foreground; agricultural crops in background.

Figure 4. Same site, north of John Young Road, with mixed stand of *Schoenoplectus hallii* (mostly) and *Echinodorus tenellus*

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Turner, B.L. 2011. A new species of *Alepidocline* (Asteraceae: Heliantheae) from Oaxaca, Mexico. Phytoneuron 2011-44: 1–4. Published 6 Sep 2011. ISSN 2153 733X

A NEW SPECIES OF *ALEPIDOCLINE* (ASTERACEAE: HELIANTHEAE) FROM OAXACA, MEXICO

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ABSTRACT

Alepidocline pochutlana B.L. Turner is described as a new species from Oaxaca, Mexico, and **Alepidocline macrocephala** (H. Rob.) B.L. Turner, comb. nov., is brought into the genus from *Galinsoga*. A key and distribution maps for the six species of the genus is provided.
KEY WORDS: *Alepidocline*, *Galinsoga*, Heliantheae

The present treatment adds two species to the genus *Alepidocline* S.F. Blake, which now comprises six species, four of these occurring in Mexico and Central America, one in South America (Venezuela). Turner (1990) provided an overview of the genus in which four species were recognized, one of these (*A. macdonaldii*) described as new. The genus is typified by *A. trifida*, a relatively common species of Guatemala. Panero (2007) treated *Alepidocline* along with eight other genera as belonging to the subtribe Galinsoginae.

Alepidocline pochutlana B.L. Turner, sp. nov. Figs. 1, 2. TYPE: **MEXICO. Oaxaca.** Distrito Pochutla, Mpio San Miquel del Puerto, El Vijia, selva mediana subperennifolia. suelo Colorado, ca 1541 m, 16° 00' 17.7" N, 96° 06' 13.7" W, 5 Dec 2009, *J. Pascual 2305* (holotype: TEX).

Alepidocline breedlovei similis sed differt receptaculis ca. 2 mm altis glabris (vs ca. 3 mm altis valde pubescentibus), involucris ca. 12 mm latis (vs ca 6 mm), et flosculis radii 8 ligulis 5-6 mm longis (vs 11, ligulis 10-20 mm longis).

Annual herbs, 20–30 cm high. **Mid stems** sparsely pubescent with both glandular and non-glandular hairs. **Leaves** 3–6 cm long, 1.5–3.0 cm wide; petioles 1–10 mm long; blades ovate, 3-nervate from near the base, sparsely pubescent, mainly along the veins, the margins serrulate. **Ultimate peduncles** pubescent like the stems, 4–10 cm long. **Heads** 1–5, both axillary and terminal. **Involucres** hemispheric, 4–5 mm high, 6–8 mm across; bracts obovate, imbricate in 2–4 series, their apices broadly rounded, the innermost often 3-fid. **Receptacles** conical, ca 2 mm high, 1 mm across, glabrous or nearly so; palea linear-lanceolate, 1–2 mm long, readily deciduous, markedly ciliate. **Ray florets** 8, pistillate, fertile (rarely not); tubes ca 3 mm long, pubescent; ligules white, 4–5 mm long. **Disc florets** 40–50 per head; corollas yellow, ca 3 mm long; tube ca 1.5 mm long, pubescent; throat ca 1.5 mm long, 5-lobed. **Achenes** black, glabrous, ca 1 mm long, 0.6 mm wide; pappus of ca 10, readily deciduous ciliate bristles, 1.0–1.2 mm long.

The present novelty is very distinctive, easily recognized by its relatively small heads and small, glabrous receptacles with decidedly deciduous, linear-lanceolate pales. It is named for the Distrito Pochutla, where first collected.

Figure 1. *Alepidocline macrocephala*, holotype at TEX.

Alepidocline macrocephala (H. Rob.) B.L. Turner, comb. nov. *Galinsoga macrocephala* H. Rob., Phytologia 44: 429. 1979. **TYPE: VENEZUELA. Merida.** El Delgadito ad El Portochuelo, 2700 m, 18 Nov 1976, *A. Charpin et al. 13531* (holotype: US).

According to Harold Robinson (pers. comm.) this taxon is known only by the type collection at US. Nor have I been able to locate specimens elsewhere. In my treatment of the genus for Mexico, I treated *Galinsoga macrocephala* as a synonym of *A. annua*, largely on the basis of its reduced ligules and the fact that at was known only by a single collection. Comparing the characters anew, with the descriptive parameters of Robinson in his original description, I now think the taxon worthy of recognition, at least until additional collections are assembled, hence its elevation here.

The following key should facilitate recognition of the taxa concerned, their distributions shown in Figure 2.

1. Ultimate peduncles of heads 1 cm long or less; subalpine meadows, south-central Oaxaca ..... **Alepidocline macdonaldii**
1. Ultimate peduncles of heads 1–10 cm long; mostly non-alpine sites.

2. Ligules of ray florets 1–2 mm long.

3. Achenes ca 2.7 mm long; disc florets ca 25; plants of South America (Venezuela) ..... **Alepidocline macrocephala**
3. Achenes ca 1.5 mm long; disc florets numerous; plants of North America (Mexico and Guatemala) ..... **Alepidocline annua**

2. Ligules of ray florets 5–20 mm long.

4. Involucres hemispheric, the bracts subequal; leaves lanceolate, widest near the middle; Oaxaca ..... **Alepidocline trifida**
4. Involucres campanulate, the bracts markedly gradate; leaves ovate, widest near the base

5. Involucres 10–15 mm across; receptacles 3–4 mm high, densely pubescent; palea trifid or incised; Chiapas ..... **Alepidocline breedlovei**
5. Involucres 5–9 mm across; receptacles ca 2 mm high, glabrous or nearly so; palea linear-lanceolate; Oaxaca ..... **Alepidocline pochutlana**

ACKNOWLEDGEMENTS

Dr. Guy Nesom provided the Latin diagnosis and reviewed and edited the manuscript. Distribution maps are based upon specimens on file at LL-TEX. Special thanks are extended to Harold Robinson for discussion (by phone) of the possible validity of *A. macrocephala*.

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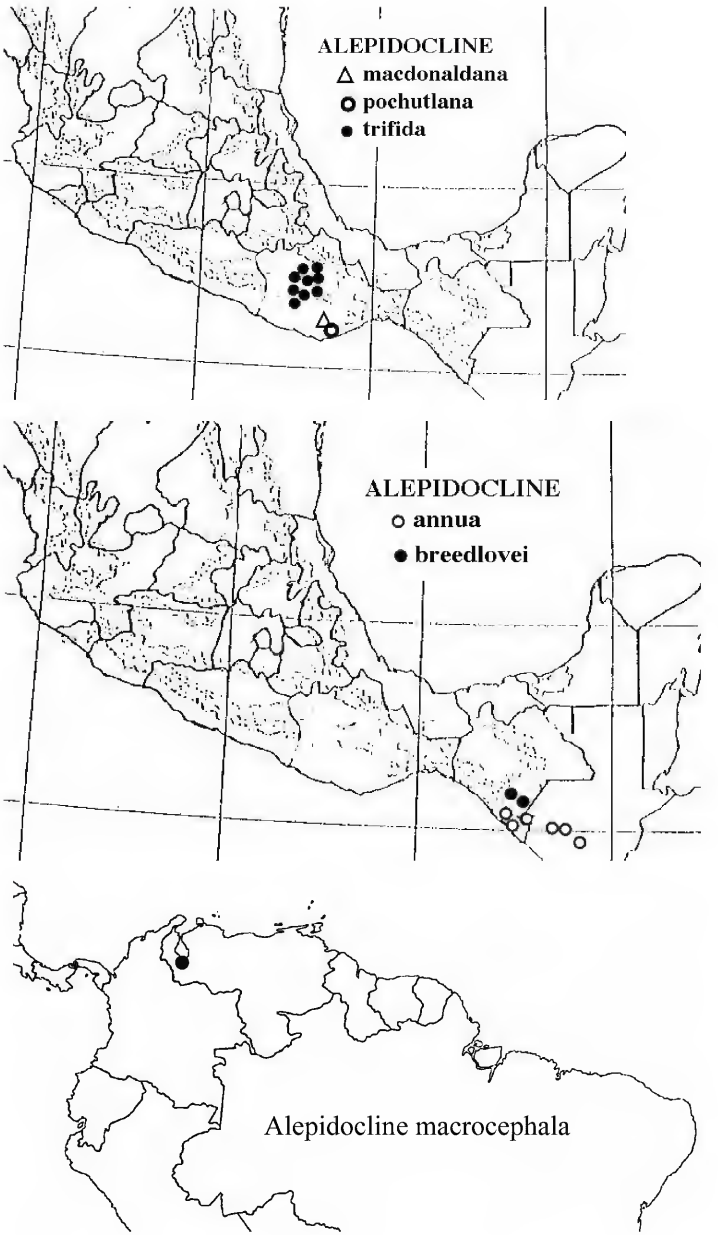

Figure 2. Maps of the six species of *Alepidocline*.

Schneider, A. and J. Bregar. 2011. *Ipomopsis ramosa* (Polemoniaceae), a new species from southwestern Colorado. Phytoneuron 2011-45: 1–11. Published 14 Sep 2011. ISSN 2153 733X

IPOMOPSIS RAMOSA (POLEMONIACEAE), A NEW SPECIES FROM SOUTHWESTERN COLORADO

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ABSTRACT

Ipomopsis ramosa Schneider & Bregar, sp. nov., is described from red sandstones, siltstones, and shales of the Permian Cutler Formation in two side canyons of the extensive Dolores River Canyon in southwest Colorado. In each side canyon, *Ipomopsis ramosa* is represented by many thousands of plants, where they grow on steep slopes in sunny meadows and open forests in moist but well-drained habitat between 8200 and 9200 feet elevation, with *Picea pungens, Pseudotsuga menziesii,* and *Populus tremuloides*. *Ipomopsis ramosa* most closely resembles *I. sancti-spiritus* and *Ipomopsis tenuituba* subsp. *tenuituba*, but *I. ramosa* is significantly different from both in morphology and geography and is justifiably considered a distinct species.

KEY WORDS: *Ipomopsis ramosa, Ipomopsis sancti-spiritus, Ipomopsis tenuituba*, Polemoniaceae, Colorado endemics

Biological exploration of San Juan National Forest in Montezuma County, Colorado, by Al and Betty Schneider in 2006 has brought to light a previously unknown species of *Ipomopsis*, described here as *Ipomopsis ramosa*.

Ipomopsis ramosa Schneider & Bregar, sp. nov. Figs. 1–7. **TYPE: USA. Colorado**. Montezuma Co.: San Juan National Forest, ca. 28 miles NE of the town of Dolores, T38N, R11W, Sections 4, 5, 9, and 10; from 37° 35.84'–108° 6.54' to 37° 34.70'–108° 3.49'; exposure of red sandstones, siltstones, and shales of the Permian Cutler formation, ca. 35% slope, with a SW, S, or SE orientation at 8200–9200 feet (2500–2800 meters); plants with open, erect, multiple stems and corollas heavily streaked and lightly dotted with coral pink; 29 Jun 2006, *A. Schneider 5085* with Betty Schneider (holotype: COLO isotypes: SBBG, RSA, MO, NY, RM, US, ASU, BRY, UNM, FLD). Several other unnumbered collections were sent to experts for study. Otherwise no further collections of *Ipomopsis ramosa* have been made.

Ipomopsi sancti-spiritus similis sed differt caulibus brevioribus maxime ramosis, corollis glandulosis albis corallini-striatis, aristis calycis brevioribus, et stylis longioribus. *Ipomopsi tenuitubae* subsp. *tenuitubae* similis sed differt habitu breviore plus ramoso et corollis ac stylis brevioribus.

Biennials to perennials from stout taproots to 24 cm long, with stout, sometimes branched caudices to 6 cm, up to 3 mm thick. **Stems**: erect, commonly multi-stemmed and usually multi-branched, main stems 25–44 cm tall, 3–4 mm thick, stiff, often red, branched 4–9(–13) times from base and along main stem, rarely simple, branches 1–2 mm thick, often to the height of the main stem(s), moderately villous and glandular proximally, moderately villous and increasingly glandular distally, becoming moderately villous and highly glandular. **Leaves**: basal rosette prominent, 5–9 cm

in diameter, leaves 2.5- 4.5 cm long, very sparsely villous, especially along rachis, leaf segments mucronate, withered black at anthesis; cauline leaves pinnatisect with linear lobes 2.5 cm long, proximal 3–5 cm long, reduced gradually distally; center of adaxial surfaces and center of lobes often strongly to lightly villous, margins commonly lightly glandular, sometimes also villous, both surfaces sparsely glandular, becoming strongly glandular distally. The glandularity produces a very noticeable and pleasant spicy fragrance. **Inflorescence**: occupying distal ½ to ¼ of the plant, of numerous pedicelled, open-paniculate clusters, the basic unit composed of 4–7 flowers, tending to be secund; pedicels at anthesis commonly 2–5 mm long, peduncles 20–30 mm long; each flower subtended by a single 3–4 mm, entire, linear, strongly glandular bract; bracts foliaceous, the uppermost bracts entire and linear, lower increasingly pinnatifid with linear lobes often entire, less than 2.5 cm long, often strongly glandular and lightly villous. **Calyx**: densely glandular, 6–7 mm long, tube ribs green and/or purple, membrane connecting ribs white or purple; lobes equal, green, 2–4(–6) mm long, linear-lanceolate, attenuate with a non-herbaceous spinulose tip. **Corolla**: salverform, slightly translucent allowing colors to show through; tube straight or occasionally slightly curved, 14–17 mm long [measured from base of tube to sinuses of lobes], 0.7–1 mm in diameter at base, 1.7–2 mm in diameter at orifice, moderately to heavily glandular-puberulent, heavily coral pink streaked on white background, infrequently completely coral pink, fading abruptly to all white within the calyx; lobes 8 mm long, attenuate, spreading or slightly to moderately reflexed, the adaxial surface of the lobes white with scattered coral pink dots, becoming light coral pink and coral pink dotted toward the apex; abaxial surface white with numerous wide coral pink streaks. In bud, the dorsal surface of the lobes appears orange, in contrast to the coral pink tube. From a distance the overall appearance of the corolla is salmon though close-up examination shows it to be white with coral pink streaks and dots. **Stamens**: deeply included, unequal in length, unequally inserted on the tube; free part of filaments 0.1–1 mm long; anther sac 0.7 mm long by 0.5 mm wide, basifixed, vertical in tube; anther sac on lowest stamen in tube is 5 to 7 mm above base of the tube; anther sac on highest stamen in tube is 7–10 mm above base of the tube; pollen yellow. **Carpels**: 2–3.5 mm long (excluding the stigmas), style very deeply included, stigma lobes 0.5 mm long, usually terminating below the anthers at anthesis. **Fruit**: obpyriform capsules, 3–4 mm long x 1.2 mm wide and green when corolla abscises; 5–6 mm long x 1.5 mm wide and tan at maturity. **Seeds**: 2–3 per locule, cylindric, young seeds bright green, 1 mm long x 0.3 mm wide, encased in milky, gelatinous substance; mature seeds dull green, 2+ mm long x 0.5-1 mm wide, encased in the now buff-colored, solidified gelatinous substance; seed coat mucilaginous when wet. **Chromosome number** unknown. The format of the description generally matches that of Wilken and Fletcher (1988) and Wilken and Porter (2005).

The specific epithet, "ramosa," means "many-branched" and was chosen because the branching of this species is a prominent and distinguishing visual characteristic. We suggest the common name "Coral Ipomopsis."

Within several hundred miles of the populations of the new species are four *Ipomopsis* species that superficially resemble it but that differ from it in significant morphological, geographical, and ecological characteristics.

Ipomopsis aggregata (Pursh) Grant, very common in the immediate vicinity of *I. ramosa*, is markedly different in its corolla color (usually scarlet) and in its much larger dimensions: it grows to 100 cm tall with corolla tubes to 30 mm long, styles 6–18 mm long, calyces 3–6 mm long, and capsules 8–12 mm long. Some details from Wilken and Porter (2005).

Ipomopsis arizonica (Greene) Wherry resembles *I. aggregata* in a number of its morphological features and has been considered a variety of that species by Cronquist et al. (1984) and Welsh et al. (2008). It is found 250–450 miles southwest of the Colorado canyons in which *I. ramosa* is

found and is significantly distinct from *I. ramosa* having mostly single stems, glabrous to sparingly glandular upper internode pubescence, calyx lobes 1–3 mm long, scarlet corolla, stamens attached at the same level, style length 4.5–10 mm, stigma at same level as anthers, and habitat of pinyon-juniper or scrub-oak woodland. Most details from Wilken and Fletcher (1988).

Ipomopsis tenuituba (Rydb.) V.E. Grant has its closest populations in the Abajo Mountains, Utah, 70 miles west of the *I. ramosa* populations. Its corollas are commonly satin white, salmon, lavender, or pink and it is significantly larger than *I. ramosa* in many of its dimensions. It grows to 100 cm tall with corolla tubes 25–45 mm long, throat 2–4 mm wide, anthers included to slightly exserted, stigma slightly exserted to included, styles are 16-35 mm long, and capsules 5–8 mm long. *I. tenuituba* grows on a variety of substrates in high montane meadows and open aspen and conifer forests. Some details from Wilken and Porter (2005), Wilken (1993), and Grant and Wilken 1988. (Note: a Dolores Co., Colorado, specimen identified by Moore in 1995 as *I. tenuituba* (RM 714481) was, according to Ron Hartman, misidentified. The specimen is *I. aggregata*.)

Ipomopsis sancti-spiritus Wilken & Fletcher is found 180 miles southeast of *I. ramosa* in one small, rare, and endangered population in San Miguel Co., New Mexico. It grows from 30-80 cm tall and has solitary stems. Corollas are uniformly pink to hot pink, glabrous; tubes are 15-18 mm long; calyces are green, white, and purple, 5-7 mm long; styles are 1.3-2 mm long; stamens are deeply included; capsules are 4-5 mm long. It is found from 7600 feet to 8200 feet on substrate derived from the Terrero and Espiritu Santo Formation, primarily a sandy to pebbly limestone conglomerate. Most details from Wilken and Fletcher (1988), NMRPTC (2011), and personal communications from Phil Tonne and Bob Sivinski.

Ipomopsis ramosa grows from 25–44 cm tall and commonly has multiple stems almost always with numerous branches. Corollas are white with short streaks and dots of coral pink; tubes are slightly translucent, strongly glandular, 14–17 mm long; calyces are green, white, and purple, 6–7 mm long; styles are 2.5–4 mm long; stamens are deeply included; capsules are 5–6 mm long. It occurs from 8200–9200 feet on red sandstones, siltstones, and shales of the Permian Cutler Formation.

The species most similar to *Ipomopsis ramosa* are *I. sancti-spiritus* and *I. tenuituba* subsp. *tenuituba*. The three are similar in their generally dense glandularity, open to narrow, often 1-sided inflorescences, and short-pedicelled to subsessile flowers in lateral peduncular clusters. *I. ramosa* and *I. sancti-spiritus* are further similar in their short, pink or coral pink and white corollas, very short styles, calyx dimensions, and deeply included anthers. *Ipomopsis ramosa* and *I. tenuituba* subsp. *tenuituba* are further similar in their dense upper internode glandularity, calyx colors, dotted pattern on corolla lobes, glandularity of corolla, and shape of corolla lobes.

Differences between *Ipomopsis ramosa* and *I. sancti-spiritus* and *I. tenuituba* ssp. *tenuituba* are summarized in the following pair of couplets and in Table 1.

1. Stems commonly multiple, frequently branched, 25–44 cm tall, densely glandular and moderately villous upward; corolla tubes slightly translucent, heavily coral pink streaked, ventral surface of lobes lightly coral pink dotted, dorsal surface moderately coral pink streaked, moderately to heavily glandular, tubes 14–17 mm; style 2.5–4 mm at anthesis; stamens deeply inserted 5–10 mm above the base of the tube; filaments 0.1–1 mm long, straight; habitat over sandstones, siltstones, and shales at 8200–9200 feet ..... **Ipomopsis ramosa**

1. Stems mostly simple, occasionally branched, 30–80 cm tall, densely glandular upward; corollas uniformly pink to hot pink, glabrous, tubes 15–18 mm; style 1.3–2 mm at anthesis; stamens deeply inserted 4–6.5 mm above the base of the tube; filaments 0.4–0.6 mm long; habitat over limestone at 7600–8200 feet ..... **Ipomopsis sancti-spiritus**

1. Stems commonly multiple, frequently branched, 25–44 cm tall, not woody at base, densely glandular and moderately villous upward; calyx awn 0.2–0.3 mm long; corolla tubes slightly translucent, heavily coral pink streaked, ventral surface of lobes lightly coral pink dotted, dorsal surface moderately coral pink streaked, moderately to heavily glandular, tubes 14–17 mm, throat 1.7–2 mm wide; style 2.5–4 mm at anthesis, very deeply inserted; stamens deeply inserted 5–10 mm above the base of the tube; filaments 0.1–1 mm long, straight; habitat over sandstones, siltstones, and shales at 8200–9200 feet ..... **Ipomopsis ramosa**
1. Stems usually simple, occasionally branched, 35–100 cm tall, often woody at base, densely glandular upward; calyx awn 0.6–0.9 mm long; corolla tubes and lobes satin, commonly white, salmon, lavender, or pink, lightly to moderately glandular, ventral surface of lobes occasionally dotted, tubes 25–45 mm, throat 2–4 mm wide; style 16–35 mm at anthesis, stigma may be slightly exserted; stamens inserted to 6 mm or some or all exserted to 2 mm; filaments 1–1.5, often kinked; habitat various montane meadows and open aspen and conifer forests
..... **Ipomopsis tenuituba subsp. tenuituba**

Habitat and occurrence.

Ipomopsis ramosa is currently known exclusively from two large populations, one in its type locale, a five mile stretch of the Roaring Fork Canyon, 28 miles northeast of Dolores, and the other in a one mile stretch of Wildcat Canyon, thee miles north of the Roaring Fork — both in Montezuma Co., Colorado. The new species is represented by thousands of plants in each canyon and it is among the more abundant species in its habitat. Explorations in nearby canyons with similar Cutler Formation and similar southerly orientations have so far revealed no further populations; additional searches will be needed to determine if there are more populations of the new species on the high, steep slopes in Roaring Fork and Wildcat Canyons and if there are populations in nearby canyons.

Ipomopsis ramosa occurs most often as well separated individual plants but it does occasionally occur in small clusters. Plants most often occur on sparsely vegetated soils on steep slopes (ca. 35%) with a southwest, south, or southeast orientation. The new species grows in well drained soils and on rocky ledges derived from red sandstones, siltstones, and shales of the Permian Cutler Formation. The plants flower from early June into September. Over the extent of its habitat, *I. ramosa* is very uniform in morphology.

At the type locality *Ipomopsis ramosa* grows with the following **dominant woody plants**: *Picea pungens*, *Pseudotsuga menziesii*, *Populus tremuloides*, *Juniperus communis*, and *Rosa woodsii*. **Less common woody plants**: *Pinus flexilis*, *Quercus gambelii*, *Amelanchier alnifolia*, *Lonicera involucrata*, *Populus angustifolia*, and *Salix* spp. **Associated dominant forbs**: *Heterotheca villosa*, *Ipomopsis aggregata*, *Packera neomexicana*, *Fragaria virginiana*, *Lathyrus lanszwertii* var. *leucanthus*, *Geranium caespitosum*, *Geranium richardsonii*, *Cymopterus lemmonii*, *Penstemon strictus*, *Oenothera elata*, *Galium boreale*, *Achillea millefolium*, *Lithospermum multiflorum*, *Erigeron speciosus*, *Erigeron flagellaris*, *Potentilla pulcherrima*, *Apocynum androsaemifolium*, *Castilleja miniata*, *Oreochrysum parryi*, *Hedysarum occidentale*, *Eriogonum ovalifolium*, *Valeriana edulis*, *Viola adunca*, and various grasses.

Table 1. *Ipomopsis ramosa* compared to *Ipomopsis sancti-spiritus* and *Ipomopsis tenuituba* ssp. *tenuituba*. The most significant contrasts are in bold.

	I. ramosa	*I. sancti-spiritus*	**I. tenuituba* ssp. *tenuituba*
Location, habitat, elevation	sw Colorado; spruce, douglas fir, aspen; steep SE, S, or SW slopes; 8200–9200 feet; on red **sandstones**, siltstones, and shales of the Permian Cutler Formation	central New Mexico; ponderosa, aspen; steep, SSW-facing slopes; 7600–8200 feet; on substrate derived from the Terrero and Espiritu Santo Formation, consisting primarily of a sandy to pebbly limestone conglomerate	eastern California through Nevada and Utah to Arizona and central Colorado; meadows and open woods in the high montane aspen and conifer zone on various substrates
Variability of corolla color and morphology	**highly uniform**	relatively uniform	highly variable in color (even within a single population) and dimensions
Height of plant	**25–44 cm**	30–80 cm	35–100 cm
Branching of plant	**commonly branched** from base and/or main stem	occasionally branched from base	simple to branched
Mid-cauline leaf length	20–40 mm	18–40 mm	15–45 mm
Upper internode pubescence	densely glandular and **moderately villous**	densely glandular	usually densely glandular, can be glabrous
Lateral cymes	4–7 flowers/cyme, 3–6 cymes/lateral branch	6–11 flowers	3–5 flowers/cyme
Calyx dimensions	6–7 mm long, lobes **2–4 (–6) mm**	5–7 mm long, lobes 1–2 mm	4–6 mm long, lobes 3.5–5 mm
Calyx color	tube ribs green and/or purple, membrane connecting ribs is white or purple; lobes green	tube white ventrally, purple dorsally; lobes green	tube ribs green and purple, membrane connecting ribs is white, sometimes purple; lobes purple, green distally
Calyx awn length	**0.2–0.3 mm**	0.5–1 mm	0.6–0.9 mm
Corolla color	**corolla slightly translucent; tube heavily coral pink streaked; lobes dotted and streaked coral pink**	tube and lobes pink-to-hot pink, never dotted or streaked	corolla satin; tube white, pink, hot pink, salmon, lavender, tints of blue; lobes sometimes dotted
Corolla pubescence	moderately to heavily glandular	**glabrous**	lightly to moderately glandular
Corolla tube length	14–17 mm	15–18 mm	**25–45 mm** (re: variability of style length/anther position)

Corolla lobes	acute, 8 mm long	obtuse, 6–8 mm long	acute, **11 mm long**
Style length	**2.5–4 mm**	1.3–2 mm	16–35 mm
Stigma position at anthesis	below the anthers (reverse herkogamous)	below the anthers (reverse herkogamous)	below anthers **to slightly exserted** (approach herkogamous to reverse herkogamous)
Stamens	unequally inserted 5–10 mm above base of tube, anthers well included	unequally inserted 4–6.5 mm above base of tube, anthers included	stamens unequally inserted **within 6 mm of orifice of tube, 0–5 anthers exserted to 2 mm**
Filaments	**0.1–1 mm long, straight**	0.4–0.6 mm long	1–1.5 mm (often kinked)
Pollen	**yellow**	light yellow to bluish	white to yellow, rarely blue
Seeds	2–3 per locule, the seed casing becomes mucilaginous when wet	2–4 per locule, the seed casing becomes mucilaginous when wet	unknown

*Details about *I. tenuituba* are from a variety of sources (personal measurements of plants in the Abajo Mountains; Welsh et al. 2008; Cronquist 1984; Wilken 1993, Grant & Wilken 1988) and may not be exact for all populations of this highly variable species over its entire range.

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Figure 1 High above the Roaring Fork Creek, the road climbs 1500 feet along the canyon walls which are the type locale for *Ipomopsis ramosa* The plant is found intermittently along the first 5 miles of the road as it climbs eastward from Colorado Highway 145

Figure 2. Typical rocky, steep mountainside habitat and typical spacing for *Ipomopsis ramosa* in the Roaring Fork Canyon, the type locality.

Figure 3 *Ipomopsis ramosa* grows 25–44 cm tall with multiple stems and/or branches and numerous panicles of flowers

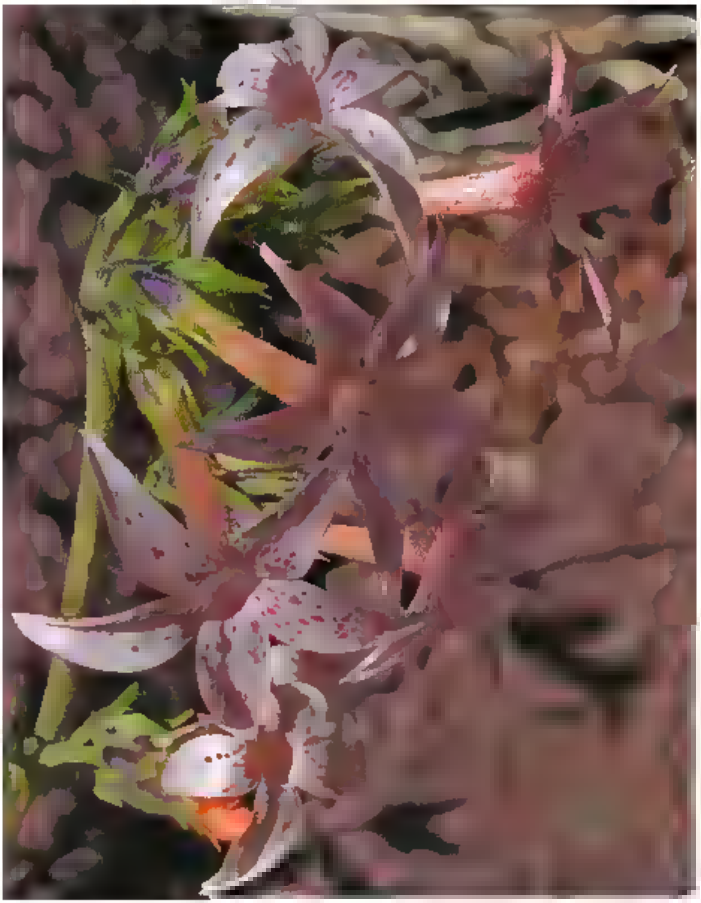

Figure 4. Corollas are slightly translucent; tubes are 14–17 mm long, 1 mm wide at their base inside the calyx, and 2 mm wide at the orifice where the lobes flare; tubes are heavily striped coral pink; lobes are 8 mm long, recurved, coral pink dotted on the ventral surface, and more heavily coral pink streaked on the dorsal surface. From a distance, the corollas appear salmon or orange, but a close up examination shows them to be coral pink and white. The center area of the tube may appear yellow but that is due to the translucency that allows the yellow anther color to show through. Calyces are strongly multi-colored and, consistent with the rest of the plant, strongly glandular.

Figure 5 Tap roots are up to 24 cm long and are topped by a caudex (shown branched here) up to 6 cm long Basal leaves are withered at anthesis

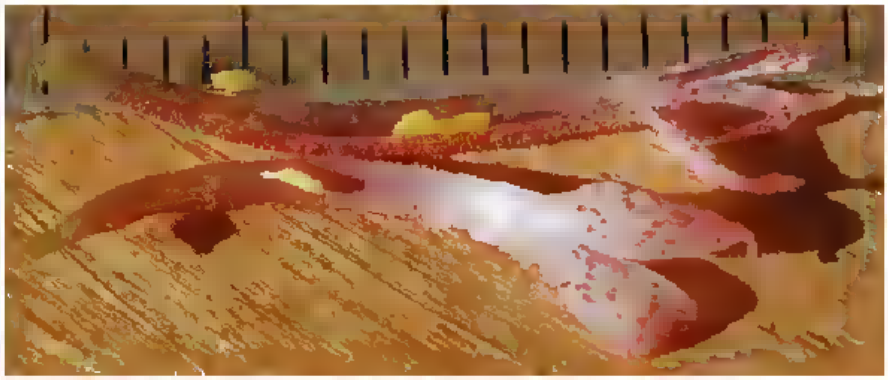

Figure 6 Stamens have very short filaments and are deeply inserted in the tube

Figure 7 A young capsule and style Styles grow to about 3 5 mm long and capsules to 5–6 mm long Notice the glandularity on both the calyx lobe and the bractlike leaf

Knapp, S., J. McNeill, and Nicholas J. Turland. 2011. Changes to publication requirements made at the XVIII International Botanical Congress in Melbourne — What does e-publication mean for you? Phytoneuron 2011-46: 1–6. Published 14 Sep 2011. ISSN 2153 733X

CHANGES TO PUBLICATION REQUIREMENTS MADE AT THE XVIII INTERNATIONAL BOTANICAL CONGRESS IN MELBOURNE – WHAT DOES E-PUBLICATION MEAN FOR YOU?

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ABSTRACT

Changes to the *International Code of Botanical Nomenclature* are decided on every 6 years at Nomenclature Sections associated with International Botanical Congresses (IBC). The XVIII IBC was held in Melbourne, Australia; the Nomenclature Section met on 18-22 July 2011 and its decisions were accepted by the Congress at its plenary session on 30 July. Several important changes were made to the *Code* as a result of this meeting that will affect publication of new names. Two of these changes will come into effect on 1 January 2012, some months before the Melbourne *Code* is published. Electronic material published online in Portable Document Format (PDF) with an International Standard Serial Number (ISSN) or an International Standard Book Number (ISBN) will constitute effective publication, and the requirement for a Latin description or diagnosis for names of new taxa will be changed to a requirement for a description or diagnosis in either Latin or English. In addition, effective from 1 January 2013, new names of organisms treated as fungi must, in order to be validly published, include in the protologue (everything associated with a name at its valid publication) the citation of an identifier issued by a recognized repository (such as MycoBank). Draft text of the new articles dealing with electronic publication is provided and best practice is outlined.

To encourage dissemination of the changes made to the International Code of Nomenclature for algae, fungi, and plants, this article will be published in *BMC Evolutionary Biology*, *Botanical Journal of the Linnean Society*, *Brittonia*, *Cladistics*, *MycoKeys*, *Mycotaxon*, *New Phytologist*, *North American Fungi*, *Novon*, *Opuscula Philolichenum*, *PhytoKeys*, *Phytoneuron*, *Phytotaxa*, *Plant Diversity and Resources*, *Systematic Botany*, and *Taxon*.

Introduction

At the XVIII International Botanical Congress in Melbourne, Australia, in July 2011, two important changes were made to the *International Code of Botanical Nomenclature* (now the *International Code of Nomenclature for algae, fungi, and plants*) that will take effect from 1 January 2012. These changes will affect everyone who publishes names governed by this *Code*. As the Melbourne *Code* will not be published until approximately mid-2012, we felt it would be helpful to

outline these changes, particularly those concerning effective publication in electronic media (in Articles 29, 30, and 31). For a concise report on all the changes to the *Code* accepted in Melbourne, see [1].

A draft wording of the revised Articles, Notes, and Recommendations on effective publication is provided to aid editors and publishers in establishing best practice for implementing this aspect of the *Code*. We also outline here what these changes do *not* mean, to guide those wishing to publish new names and typifications by electronic means. We urge readers to consult the report of the Special Committee on Electronic Publication accompanying the changes proposed before the Congress [2], wherein the reasoning for the changes now accepted into the *Code* is set out.

Draft wording of revised Articles 29, 30, and 31 and Recommendations 29A, 30A, and 31A

Here we reproduce the wording of all of the relevant Articles, Notes, and Recommendations (omitting the Examples), with the changes highlighted in **bold**. The wording here is provisional, pending the meeting of the Editorial Committee in December 2011 to finalize the printed version of the Melbourne *Code*.

Article 29

29.1. Publication is effected, under this *Code*, by distribution of printed matter (through sale, exchange or gift) to the general public or at least to botanical institutions with libraries accessible to botanists generally. **Publication is also effected by electronic distribution of material in Portable Document Format (PDF; see also Art. 29.3 and Rec. 29A.1) in an online publication with an International Standard Serial Number (ISSN) or an International Standard Book Number (ISBN).** Publication is not effected by communication of new names at a public meeting, by the placing of names in collections or gardens open to the public, by the issue of microfilm made from manuscripts, typescripts or other unpublished material, or by distribution electronically **other than as described above**.

***29.2.* For the purpose of this Article, "online" is defined as accessible electronically via the World Wide Web.**

***29.3.* Should Portable Document Format (PDF) be succeeded, a successor international standard format communicated by the General Committee (see Div. III) is acceptable.**

***29.4.* The content of a particular electronic publication must not be altered after it is first issued. Any such alterations are not themselves effectively published. Corrections or revisions must be issued separately to be effectively published.**

Recommendation 29A

[Existing Recommendation replaced by the following:]

***29A.1.* Publication electronically in Portable Document Format (PDF) should comply with the PDF/A archival standard (ISO 19005).**

***29A.2.* Authors should preferably publish in publications that are archived, satisfying the following criteria as far as is practical (see also Rec. 29A.1):**

***(a)* The material should be placed in multiple trusted online digital repositories, e.g. an ISO-certified repository;**

***(b)* Digital repositories should be in more than one area of the world and preferably on different continents;**

***(c)* Deposition of printed copies in libraries in more than one area of the world and preferably on different continents is also advisable.**

Article 30

30.1. **Publication by distribution of electronic material does not constitute effective publication before 1 January 2012.**

30.2. **An electronic publication is not effectively published if there is evidence associated with or within the publication that it is merely a preliminary version that was, or is to be, replaced by a version that the publisher considers final, in which case only that final version is effectively published.**

30.3. Publication by indelible autograph before 1 January 1953 is effective. Indelible autograph produced at a later date is not effectively published.

30.4. For the purpose of this Article, indelible autograph is handwritten material reproduced by some mechanical or graphic process (such as lithography, offset, or metallic etching).

30.5. Publication on or after 1 January 1953 in trade catalogues or non-scientific newspapers, and on or after 1 January 1973 in seed-exchange lists, does not constitute effective publication.

30.6. The distribution on or after 1 January 1953 of printed matter accompanying exsiccatae does not constitute effective publication.

Note 1. If the printed matter is also distributed independently of the exsiccata, it is effectively published.

30.7. Publication on or after 1 January 1953 of an independent non-serial work stated to be a thesis submitted to a university or other institute of education for the purpose of obtaining a degree is not effectively published unless it includes an explicit statement (referring to the requirements of the *Code* for effective publication) or other internal evidence that it is regarded as an effective publication by its author or publisher.

Note 2. The presence of an International Standard Book Number (ISBN) or a statement of the name of the printer, publisher, or distributor in the original printed version is regarded as internal evidence that the work was intended to be effectively published.

Recommendation 30A

30A.1. **Preliminary and final versions of the same electronic publication should be clearly indicated as such when they are first issued.**

30A.2. It is strongly recommended that authors avoid publishing new names and descriptions or diagnoses of new taxa (nomenclatural novelties) in ephemeral printed matter of any kind, in particular printed matter that is multiplied in restricted and uncertain numbers, in which the permanence of the text may be limited, for which effective publication in terms of number of copies is not obvious, or that is unlikely to reach the general public. Authors should also avoid publishing new names and descriptions or diagnoses in popular periodicals, in abstracting journals, or on correction slips.

30A.3. To aid availability through time and place, authors publishing nomenclatural novelties should give preference to periodicals that regularly publish taxonomic articles. **Otherwise, a copy of a publication (whether published as printed or electronic matter) should be sent to an indexing centre appropriate to the taxonomic group, and publications that exist only as printed matter** should be deposited in at least ten, but preferably more, botanical or other generally accessible libraries throughout the world.

30A.4. Authors and editors are encouraged to mention nomenclatural novelties in the summary or abstract, or list them in an index in the publication.

Article 31

31.1. The date of effective publication is the date on which the printed **or electronic** matter became available as defined in Art. 29 and 30. In the absence of proof establishing

some other date, the one appearing in the printed **or electronic** matter must be accepted as correct.

[Existing Note 1 replaced by the following:]

31.2. **When a publication is issued in parallel electronic and printed versions, these must be treated as effectively published on the same date unless the dates of the versions are different according to Art. 31.1.**

31.3. When separates from periodicals or other works placed on sale are issued in advance, the date on the separate is accepted as the date of effective publication unless there is evidence that it is erroneous.

Recommendation 31A

31A.1. The date on which the publisher or publisher's agent delivers printed matter to one of the usual carriers for distribution to the public should be accepted as its date of effective publication.

Best practice

Authors of new names, editors and publishers will all be interested in ensuring that the publications including new names are in accordance with the Melbourne *Code*, so that the names therein are effectively published. We suggest that those publishing in journals or monograph series and books that have online editions communicate with the editors so that best practice can be established across the community as quickly as possible. Many publishers have been carefully addressing the issues involved with the e-publication of novelties for some time (see [3]; guidelines in PLoS One [4]) and considerable interest in making these new *Code* changes function effectively has been apparent.

Some practices that we feel will help with the initial stages of e-publication of novelties that are according to the Melbourne *Code* are:

- Having each article bear the date of publication prominently (as is done in many journals, for example *New Phytologist* or *Nature*).
- If an online early version is issued that is not the same as the final version (and thus not the place of effective publication), stamp each article with this fact prominently (for example *American Journal of Botany*).
- Prominent display of the ISSN or ISBN of the publication on each article will help indexers establish effective publication.
- Publication in journals (or monograph series) that participate in the CLOCKSS system (see [3] for a description) or another international archive and preservation system will ensure long-term archiving.
- Authors of new names by electronic means should alert the appropriate indexing center as recommended in Rec. 30.A.3 - this will help indexers who may otherwise not be aware of electronically published names.

What these changes do *not* mean

Although the new Articles and Recommendations use the terms PDF and PDF/A, this does not mean that publications must be issued *only* in that format to be effectively published. For example, some online journals issue papers in Hypertext Markup Language (HTML) format together with a parallel PDF version. In such cases, the PDF version will be effectively published. The stipulation that the General Committee for Botanical Nomenclature will communicate the acceptability of a new international standard format, should PDF ever be succeeded, means authors of novelties and the community using the *Code* can remain informed as to advances in the field and that the *Code* will be protected from obsolescence.

Use of the following means of electronic publication will *not* result in effective publication of novelties under the Melbourne *Code*:

- Publication on websites or in ephemeral documents available over the Internet (there are strict criteria for granting of ISSNs [5]).
- Publication in journals without a registered ISSN or e-ISSN.
- Publication in books without a registered ISBN or e-ISBN.

The Recommendation approved to advise the deposition of a hard copy of any e-publication in a library suggests to botanists an action, but it does not set out standard practice or a protocol for librarians to follow. Librarians are themselves in a complex transition zone between publication modalities [6], and botanists may find librarians to be unwilling or unable to accommodate single hard copy papers as individual accessions should the volume be great.

Two other important changes to the *Code* relating to the publication of names

The second change to the *Code* approved in Melbourne to take effect from 1 January 2012 is that the description or diagnosis required for valid publication of the name of a new taxon of all organisms falling under the *Code* may be in either English or Latin. This is the current provision for names of plant fossils, but all new non-fossil taxa have required a Latin description or diagnosis (fungi and plants from 1 January 1935; algae [including cyanobacteria, if treated under the *Code*] from 1 January 1958). This has no bearing on the form of scientific names, which continue to be Latin or treated as Latin. Individual journal requirements for Latin and/or English will, of course, be determined by the editors of those journals.

A third change to the *Code* approved in Melbourne relating to publication of names, but one not taking effect until 1 January 2013 (not 1 January 2012 as reported by [7]), is that all new names of organisms treated as fungi must, as an additional requirement for valid publication, include in the protologue (everything associated with a name at its valid publication) the citation of an identifier issued by a recognized repository (such as MycoBank [8]). This will be publicized separately.

The requirement for a unique identifier for new names of fungi on or after 1 January 2013 does *not* apply to plants or algae; there is no need for authors of new names in these groups to request Life Science Identifiers (LSIDs) — or other identifiers — from indexing centers.

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To encourage dissemination of the changes made to the International Code of Nomenclature for algae, fungi, and plants, this article will be published in *BMC Evolutionary Biology*, *Botanical Journal of the Linnean Society*, *Brittonia*, *Cladistics*, *MycoKeys*, *Mycotaxon*, *New Phytologist*, *North American Fungi*, *Novon*, *Opuscula Philolichenum*, *PhytoKeys*, *Phytoneuron*, *Phytotaxa*, *Plant Diversity and Resources*, *Systematic Botany*, and *Taxon*.

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Gaddy, L.L. 2011. A new species of *Hexastylis* (Aristolochiaceae) from the Sandhills of North and South Carolina. Phytoneuron 2011-47: 1–5. Published 14 September. ISSN 2153 733X

A NEW SPECIES OF *HEXASTYLIS* (ARISTOLOCHIACEAE) FROM THE SANDHILLS OF NORTH AND SOUTH CAROLINA

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ABSTRACT

Hexastylis sorriei is a new species of *Hexastylis* from the Sandhills of the Inner Coastal Plain of the Carolinas. It is closely related to *Hexastylis minor* and has frequently been mistaken for *Hexastylis virginica*.

KEY WORDS: *Hexastylis*, *Hexastylis minor*, *Hexastylis sorriei*, *Hexastylis virginica*, Sandhills, North Carolina, South Carolina.

In the spring and summer of 2004, I conducted fieldwork at Camp Mackall, a United States military installation just south of Fort Bragg in Cumberland Co., North Carolina, in the Sandhills of the Inner Coastal Plain physiographic province. On several occasions, I encountered a strange *Hexastylis* growing on wet, acidic slopes under cinnamon fern (*Osmunda cinnamomea*) along the margins of streamhead pocosins. Most plants had only a leaf or two, and only a few plants had flowers. The calyces of the flowers were similar to those of *Hexastylis minor* (Ashe) Blomquist, a North Carolina-South Carolina-Virginia endemic found on clayey soils of the Piedmont (see Gaddy 1987 for distribution maps). A review of herbarium specimens from the area revealed that most *Hexastylis* collections from the North Carolina Sandhills had been identified as *H. minor* or *H. virginica* (L.) Small. Later, in 2005, while annotating specimens at the herbarium at the University of North Carolina at Charlotte, I saw a specimen of *Hexastylis* from an acidic, ecotonal habitat in the Sandhills of Chesterfield Co., South Carolina. It was determined to be *H. minor* and had been previously annotated by me as "possibly" *H. virginica*. Although most *Hexastylis* species are acidophiles, I found it strange that this sandhill *Hexastylis*, found in hyperacidic soils, could be *H. minor*, a common Piedmont species known for its ability to grow on the less acidic Piedmont clays. Furthermore, the calyx lobes on all the flowers of the sandhill plants I had seen in the field and the ones I had annotated were spreading (not erect as in *H. virginica*) and too long to be called *H. virginica*. I, therefore, decided to take a closer look at these sandhill plants.

In the spring of 2005 through the spring of 2011, I made additional field trips to Fort Bragg and the Sandhills of North and South Carolina and saw the same plant at various wet, acidic habitats — even growing with *Dionaea muscipula* at one site and with *Sarracenia purpurea* and *Sarracenia rubra* at another. I collected numerous flowers at each site for morphological studies. In the spring of 2005, I visited the Chesterfield Co. population and studied fresh flowers from there. In the winter of 2007, I reviewed the holdings of the herbarium at the University of North Carolina-Chapel Hill (NCU). In the spring of 2007, I revisited most of the populations identified as *Hexastylis minor* and *H. virginica* in Cumberland, Harnett, Hoke, Moore, Richmond, Robeson, and Scotland counties. None of the populations I visited in the xeric Sandhills of North Carolina appeared to be either good *H. minor* or *H. virginica*.

After several years of observation and analysis of the floral and leaf characteristics of these sandhill *Hexastylis* plants, I have concluded that these populations represent a new species of *Hexastylis*, which I am calling *Hexastylis sorriei*, the Sandhills Heartleaf. I take pleasure in naming

this species after Mr. Bruce A. Sorrie, Research Associate at the UNC-Chapel Hill Herbarium, sandhill botanist and naturalist.

HEXASTYLIS SORRIEI Gaddy, sp. nov., Figures 1 and 3. **TYPE: USA. North Carolina**. Hoke Co.: In burned ecotonal area under *Osmunda cinnamomea*, along E side of Juniper Creek just S of Plank Road, ca. 5 mi NNW of Raeford, on Fort Bragg Military Installation, 14 May 2007, *L.L. Gaddy 051407* (holotype: USCH).

Hexastyli minor (Ashe) Blomquist affinis sed differt foliis non variegatis vel leviter variegatis; *Hexastyli virginicae* (L.) Small affinis sed differt lobis calycis patentibus (non erectis).

Rhizomes: internodes short, leaves crowded at rhizome apex. **Leaf blades**: variegated to not variegated, cordate, usually 2–8 leaves per plant. **Flowers**: usually 2–4 flowers per plant, calyx tube cylindric to cylindric-campanulate, sometimes with a prominent transverse ridge (flare) just below the sinuses, calyx length 8–18 mm, calyx width 8–16 mm (flare to 16 mm wide), inner surface longitudinally ridged with reticulations between ridges, reticulation deep and finely dissected, calyx tube thin and easily torn, calyx lobes 4–8 mm long, spreading, 6–8 mm long, 10–12 mm wide, adaxially puberulent; stamen connective not extending beyond pollen sacs; ovary ca. 1/3 inferior, ovules 6 per locule; style notched at apex (format follows Whittemore and Gaddy 1997).

Hexastylis sorriei is most similar and probably most closely related to *Hexastylis minor*. It differs from *H. minor*, however, in many ways: 1) the leaves of *H. sorriei* display sparse to no variegation, while those of *H. minor* are densely variegated, almost to the point of being white in the central portion of the leaf, as shown in Fig. 2; 2) the flowers of *H. sorriei* are generally smaller than those of *H. minor* and have greater color variation (the flowers of *H. minor* are nearly always purple or whitish-purple, Fig. 4 — those of *H. sorriei* often have white or greenish-white bases and are frequently greenish when they first open); and 3) the internal ridged reticulation in the flowers of *H. sorriei* is usually more finely dissected and deeper than that found in the flowers of *H. minor*.

Additional collections examined: **NORTH CAROLINA. Cumberland Co.**: Fort Bragg Military Reservation, south side of Little River, 1.1 mi E of Lamont Road, 17 April 1993, *B.A. Sorrie* (NCU); sandy area above cypress pond with *Vaccinium*, Gordon Butler Nature Preserve, Hope Mills, 30 March 1990, *D.P. Jensen 3* (NCU). **Moore Co.**: deciduous thicket near stream, Weymouth Woods—SNP, Southern Pines, 08 April 1973, *J.H. Carter, 453* (NCU). **Richmond Co.**: bay forest, Hitchcock Creek, 3 ½ miles west of Marston, *19 May 1956, A.E. Radford 11356* (NCU); **Robeson Co.**: margin of pocosin 3 ½ mi. northwest of Parkton near county line, 5 April 1958, *R.F. Britt 1616* (NCU). **SOUTH CAROLINA. Lancaster Co.**: in thicket margins of streamhead pocosin with *Osmunda cinnamomea* and *Fothergilla gardenii* on headwaters of unnamed creek approximately 3 mi SSE of Kershaw (0.4 mi NE of jct of County Roads 770 and 769), 4 May 2007, *L.L. Gaddy 050407* (USCH). **Chesterfield Co.**: Carolina Sandhills National Wildlife Refuge, thickety woods at Lake 12, 2 May 1982, *Tom Daggy 8953* (UNCC).

There is a *Hexastylis* specimen from Darlington Co., South Carolina, that is labeled *Hexastylis virginica*. This specimen has been cited (Blomquist 1957; Radford et al. 1968; Gaddy 1987) as the only South Carolina record for this species. I revisited the site (the boggy edges of a sandhill pond) but could not find any *Hexastylis* plants. Based on the habitat, however, I am confident that this collection was from a population of *H. sorriei*. *Hexastylis virginica* probably does not occur in South Carolina. **Darlington Co.**: Kilgore's Pond woods, *21 Apr 1932, Budd Smith s.n.* (NCU).

Figure 1 *Hexastylis sorriei* leaves emerging from soil after a fire (note lack of variegation)

Hexastylis sorriei is noteworthy in its ability to withstand and prosper in an ecotonal habitats exposed to frequent, hot fires Here, the Sandhills Heartleaf grows with *Nyssa biflora*, *Acer rubrum*, [rarely with *Chamaecyparis thyoides*, *Osmunda cinnamomea*, *Clethra alnifolia*, *Ilex glabra*, *Ilex coriacea*, *Lyonia lucida*, *Cyrilla racemiflora*, *Fothergilla gardenii*, *Magnolia virginiana*, *Persea palustris*, *Sarracenia rubra*, *Sarracenia purpurea*, *Sphagnum* spp , and, very rarely, *Dionaea muscipula* (the latter only in North Carolina) The first year after fire, *Hexastylis sorriei* sprouts and flowers The second year after fire, as its habitat gradually becomes more crowded with stems of other species, it produces fewer leaves and flowers After several years without fire, most plants have only one or two leaves and flowers are very hard to find Some historic locations where fire has been absent for decades have no plants at all today Even with fire, it produces smaller clumps than most species of *Hexastylis* — a "large" clump of *H sorriei* has about 8 leaves and 4 flowers, while in other species of *Hexastylis*, healthy clumps often have around 20 leaves and nearly as many flowers *Hexastylis sorriei* can generally be said to be rare and local Fort Bragg and Camp Mackall, where annual burning is widespread, are the only locations where the Sandhills Heartleaf can be said to be common

Figure 2. *Hexastylis minor* — typical densely variegated leaf.

Key to *Hexastylis sorriei* and Related Species

1. Calyx tube cylindrical to urceolate, lobes 2–4 mm long ..... ***Hexastylis virginica***
1. Calyx tube cylindrical, lobes 4–15 mm long.

    2. Calyx tube longer than wide.

        3. Calyx tube opening 8–12 mm wide, greater than ½ lobe length ..... ***Hexastylis heterophylla***
        3. Calyx tube opening 3–8 mm wide, less than ½ lobe length ..... ***Hexastylis naniflora***

    2. Calyx tube about as wide as long, or wider than long.

        4. Calyx tube about as long as wide, opening width less than the lobe length ..... ***Hexastylis heterophylla***
        4. Calyx tube wider than long, opening width greater than the lobe length.

            5. Calyx tube 12–25 mm long, leaves always densely variegated ..... ***Hexastylis minor***
            5. Calyx tube 8–18 mm long, leaves sparsely variegated to not variegated . ***Hexastylis sorriei***

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Figure 3. Flowers of *Hexastylis sorriei* Gaddy.

Figure 4. *Hexastylis* flowers left to right: *H. virginica* (note short, erect calyx lobes), *H. heterophylla*, *H. minor*, and *H. naniflora*. Note white bases of *heterophylla* and *naniflora*.

Buthod, A. 2011. New to Oklahoma: *Hypochaeris glabra* (Asteraceae). Phytoneuron 2011-48: 1–2. Published 3 Oct 2011. ISSN 2153 733X

NEW TO OKLAHOMA: *HYPOCHAERIS GLABRA* L. (ASTERACEAE)

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ABSTRACT

This paper documents the occurrence of a vascular plant species previously unknown to the flora of Oklahoma. *Hypochaeris glabra* L., a native of Europe, was discovered in a naturalized population in McCurtain County in southeastern Oklahoma.
KEY WORDS: *Hypochaeris glabra*, Asteraceae, Oklahoma, exotic

Hypochaeris glabra L. (Asteraceae, Cichorieae; smooth cat's ear) is an annual species native to Europe (Bogler 2006). In North America, it has been reported from Pacific coast states, the Northeast, and the Southeast, including the states of Arkansas and Texas (Kartesz 2011; USDA, NRCS 2011). The population documented here was growing in a frequently mowed cemetery just west of Redland, Oklahoma. Associated species included *Carex* sp., *Medicago* sp., and a large population of *Escobaria missouriensis*. About fifty plants of the *Hypochaeris* were noted. This is the first report of the species in the state of Oklahoma (Hoagland et al. 2011).

Hypochaeris glabra L. **Oklahoma.** McCurtain Co.: From Redland, 0.8 mi W and 0.5 mi N on E side of road at Redland Cemetery; 15 S 344004 3754285; T7S R25E Sec. 27, 19 Apr 2011, *Buthod AB-9193* (OKL). Figure 1.

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Figure 1. *Hypochaeris glabra* from the reported population in McCurtain Co., Oklahoma.

Mink, J.N., J.R. Singhurst, M. White, and W.C. Holmes. 2011. *Centaurium tenuiflorum* (Gentianaceae) new to Oklahoma and notes on *Centaurium texense* in Mexico. Phytoneuron 2011-49: 1–3. Published 3 Oct 2011. ISSN 2153 733X

CENTAURIUM TENUIFLORUM (GENTIANACEAE) NEW TO OKLAHOMA AND NOTES ON *CENTAURIUM TEXENSE* IN MEXICO

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ABSTRACT

Centaurium tenuiflorum is reported for the first time as occurring in Oklahoma. *Centaurium texense* is reported from Monterrey, Nuevo Leon, Mexico.
Key Words: Gentianaceae, *Centaurium,* Oklahoma, United States, Nuevo León, Mexico.

Based on the collection of the following specimens, we report *Centaurium tenuiflorum* (Hoffmsgg. & Link.) Fritzch as new to the Oklahoma flora.

USA. **Oklahoma**. Bryan Co.: Red River floodplain, 100 meters W of jct. of Oklahoma Hwy 75 and the Red River, 19 Jul 2011, *J.R. Singhurst & M.White 18690* (BAYLU); same location, 1 Jul 2011, *M. White s.n.* (BAYLU).

Centaurium tenuiflorum has been reported under the name *Centaurium muehlenbergii* (Griseb.) W. Wright ex Piper in Texas, Louisiana, and Mississippi by Holmes and Wivagg (1996). Use of this name was based upon Hickman (1993), where *C. tenuiflorum* is listed as a synonym of *C. muehlenbergii*. However, *C. tenuiflorum* is currently recognized as distinct from *C. muehlenbergii* (Pringle 2010). Additionally, if the two centauriums are considered conspecific (as published in Hickman 1993), the basionym of *C. tenuiflorum* (*Erythraea tenuiflora* Hoffmsgg. & Link, Fl. Portug. 1, 354, t. 67. 1809) has priority. The basionym of *C. muehlenbergii* is *Erythraea muehlenbergii* Griseb., Gen. Sp. Gent. 146. 1838. Taxonomic disagreements are not unique to North American centauriums as dispute in European species status has occurred periodically since Linnaeus first united centauries with the gentians in 1753 (see nomenclature enumerated and listed in Gilmour 1937).

Centaurium tenuiflorum is native to western and southern Europe. It has been introduced and naturalized in California and Oregon in addition to the states mentioned above. The species tends to be "weedy," occurring in pastures, waste places, disturbed areas, and roadsides. It is often confused with *C. texense* (Griseb.) Fern. but may be distinguished by its habitat preference (weedy areas), robust size (generally 30 cm or more tall), flat-topped corymb, and more or less sessile flowers. *Centaurium texense* normally occurs on eroded limestone, has a more open and paniculate inflorescence, is normally less than 20 cm tall (occasionally up to 30 cm), and has pedicels about the same length as the calyces.

Notes on *Centaurium texense* in Mexico.

Centaurium texense (Griseb.) Fern. is distributed from southeast Kansas and southwest Missouri, southward through Arkansas and Oklahoma to central Texas (Correll & Johnston 1970; Fernald 1950; USDA, NRCS 2011). In Texas, Turner et. al. (2003) mapped the species south to Bexar County. Since there is no mention in the above references (or distributional documentation by others, e.g., Steyermark 1963; McGregor & Barkley 1977) of the species occurring elsewhere, it is reasonable to conclude that the species is endemic to the USA, although this is not directly stated. Study in the U.S. National Herbarium in July 2003 by W.C. Holmes resulted in the discovery of a specimen of *C. texense* from Mexico. This is the first report of the species in that country and establishes the non-endemic status of the species in the USA.

MEXICO. Nuevo León. Monterrey, 26 Jul 1926, *G.L. Fisher 228* (US). The specimen was independently annotated as *Centaurium texense* (Griseb.) Fern. in 1975 by C. Rose Broome and R.L. Wilbur.

George L. Fisher (1868-1953) was a professional collector who sold and exchanged botanical specimens, making numerous collecting trips into Mexico. The collection from Monterrey is out of range but collected by a reputable (competent) botanist. In connection with the U.S. National Herbarium (US), Fisher ran the American Botanical Exchange (described in Vasey 1888) from his Texas residence in Houston. A brief obituary is in Shinners (1954), as well as an unattributed note in Taxon 3(8): 247 correcting Fisher's date of birth.

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SPECIES RICHNESS AFTER *LONICERA MAACKII* REMOVAL FROM AN OLD CEMETERY MACROPLOT ON DEAD HORSE KNOB, MADISON COUNTY, KENTUCKY

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ABSTRACT

The predominance of *Lonicera maackii* (Rupr.) Herder (Amur Honeysuckle) in central Kentucky has made it a significant invasive for continued community interaction studies. To better understand the dynamics of vegetation succession with respect to this species and overall species richness, quantitative floristics of two macroplots were made at the summit (312 m) of Dead Horse Knob (Rucker's Knob) near Berea, in Madison County, east-central Kentucky. An old abandoned cemetery was cleared of *L. maackii* and a macroplot (20 x 12 m) served as a test plot, while a second macroplot was placed within a dense thicket of *L. maackii* to serve as a reference plot. Thirty quadrats (1 x 1 m) were randomly placed within each macroplot as a means to determine species frequency. A full floristic survey was then conducted of each macroplot. Results from frequency data suggest that native annual and perennial species will quickly recolonize an area after removal of Amur Honeysuckle and become the most important components of the site. Likewise, floristic data demonstrated nearly a three-fold increase in species richness (60 taxa) in the test macroplot after removal of Amur Honeysuckle compared to species richness (21 taxa) in the reference macroplot. In the absence of Amur Honeysuckle, vegetation has resulted in a significantly different floristic assemblage between macroplots. Frequency data from the cleared test macroplot indicate that *L. maackii* will remain viable through seedling recruitment, and without further control or disturbance, an understory thicket of Amur Honeysuckle will undoubtedly be reestablished at this site.

KEY WORDS: Amur honeysuckle, exotics, invasives, Kentucky, *Lonicera maackii*, species richness

The most aggressive invasive species with the greatest deleterious impact on the total vegetation and native plants in central Kentucky is undoubtedly *Lonicera maackii* (Rupr.) Herder (Amur Honeysuckle). In east-central Kentucky, Campbell et al. (1995) noted that *L. maackii* was the most abundant, widespread exotic shrub in successional forests at Raven Run Nature Sanctuary in adjacent Fayette County. Thompson et al. (2005) and Thompson and Green (2010) reported the abundance and aggressive impact of *L. maackii* on the floristic composition and habitats in two studies of abandoned limestone quarries in the Outer Bluegrass Region of contiguous Clark County and Garrard County. In neighboring Ohio, Amur Honeysuckle is considered the most abundant naturalized shrub in the Greater Cincinnati region (Luken & Thieret 1995). Its severe impact on the flora and natural vegetation of the eastern USA has become extremely detrimental in reducing native herbaceous

cover, shrub and tree seedlings, and species diversity (Gorchov & Trisel 2003; Rundle et al. 2007; Clark & Weckman 2008).

Luken and Thieret (1995) presented a 150-year chronology of the interaction between people and the introduction of *Lonicera maackii*, an invasive east Asian shrub from the Amur River region of Manchuria. Amur Honeysuckle is a fast-growing, multi-stemmed, deciduous shrub up to 6 meters high that produces attractive axillary flowers and red berries in the leaf axils of opposite simple leaves. The fruits are readily disseminated by avian vectors (Ingold & Craycraft 1983; Bartuszevige & Gorchov 2006). This shrub was introduced into North America in 1896 and was much used in horticultural settings and as an ornamental landscaping plant; ironically, *L. maackii* was initially promoted by the USDA Soil Conservation Service (Luken & Thieret 1995, 1996). Amur Honeysuckle was much planted in arboreta, botanical gardens, parks, college and university campuses, government plots, and by the general public until the 1960s. By 1994, Amur Honeysuckle had migrated into at least 24 states (Trisel & Gorchov 1994). Unfortunately, even though its disastrous influences on natural plant communities have been repeatedly documented, *L. maackii* continues to be sold by numerous plant nurseries as a garden and landscaping plant in the USA according to an Internet search of active websites.

Research focusing on competition and allelopathic effects of *Lonicera maackii* on native flora and natural vegetation, its persistent migration, as well as mechanisms for the control of this invasive species have been extensively documented in recent literature from Kentucky (e.g., Luken 1988; Luken & Mattimiro 1991; Luken & Goessling 1995; Luken et al. 1995a, 1995b; Luken et al. 1997), and Ohio (e.g., Ingold & Craycraft 1983; Trisel & Gorchov 1994; Hutchinson & Vankat 1997, 1998; Medley 1997; Trisel 1997; Deering & Vankat 1999; Gould & Gorchov 2000; Gayek & Quigley 2001; Collier et al. 2002; Gorchov & Trisel 2003; Hartman & McCarthy 2004; Miller & Gorchov 2004; Bartuszevige & Gorchov 2006; Dorning & Cipollini 2006; Runkle et al. 2007).

Regardless of the large amount of current research (as exemplified above) that has provided ample evidence for a focused management of Amur Honeysuckle, it is still only regionally regarded as an invasive plant pest (MA-EPPC 2011; SE-EPPC 2011). It has yet to be recognized as a Kentucky or Federal Noxious Weed (see USDA, NRCS 2011). Nevertheless, this is not an unusual issue since other severe invasive species [e.g., *Persicaria perfoliata* (L.) H. Gross (Mile-a-minute-vine)] have yet to be Federally listed despite their rampant spread (Poindexter 2010). In consideration of this, it seems rational to continue to produce studies such as this one to help elucidate the impacts of Amur Honeysuckle on local vegetation.

We conducted a quantitative floristic study on the summit of Dead Horse Knob in east-central Kentucky, during the summer of 2011. Our objectives were to: 1) determine frequency of taxa through 30 (1 x 1 m) quadrats each within two 20 x 12 m macroplots (one a test plot and one a *Lonicera maackii* reference plot) for species richness, species composition, and overall floristic diversity; 2) survey the two macroplots for species not present in quadrats; 3) document the competitive effects of *L. maackii* as a means to provide further data on its negative impact on native flora and vegetation; and 4) promote the need for elevating this species to the forefront of controlled management efforts in the eastern USA.

THE STUDY SITE

Dead Horse Knob (hereafter DHK or knob) is an isolated, dome-shaped, solitary 2.6-ha "knob" near the city of Berea within southern Madison County, Kentucky (Figure 1). The DHK site is a part of the 270-ha Berea College Farm and is surrounded by open agriculture and pasture land (Thompson et al. 2008). It lies within the Knobs-Norman Upland Ecoregion of the Interior Plateau

Physiographic Province (Woods et al. 2002) at 37.583591°N and 84.298871°W (Figure 1). Vegetation in this ecoregion is highly altered Oak-Hickory Forest (Woods et al. 2002).

The study site is located at the summit (312 m) of DHK where a dense thicket of *Lonicera maackii* constitutes much of the understory cover throughout the highly disturbed Dry-Mesic Oak-Hickory Forest. On the DHK summit, Coyler shaly silt loam is the shallow, strongly acid (4.5-5.0 pH), excessively well-drained soil derived from weathered Devonian New Albany shale (Weir 1969). While identified on topographic maps as Dead Horse Knob, it is also recognized as Rucker's Knob by many local people due to a small private cemetery, the Pullins-Rucker Cemetery, on the knob crest. The family cemetery began with the interment of a Revolutionary War veteran, Loftus Pullins, Jr. (1764-1841), and some of his descendents.

The cemetery understory was covered by Amur Honeysuckle along with a few other invasive woody plants, a few pole-sized and mature canopy trees, and a very sparse herbaceous layer. The shrubbery was partially removed from the cemetery in September of 1981 for a commemorative ceremony held by the Madison County DAR and SAR (Daughters and Sons of the American Revolution) organizations on November 8, 1981, to recognize the contributions of Loftus Pullins, Jr. and to dedicate a flat marble monument to his memory.

Afterwards, the cemetery soon was abandoned and secondary succession was allowed to occur. Over the next 30 years, the Pullins-Rucker Cemetery understory became dominated by a dense thicket of *Lonicera maackii* and other invasive shrubs and vines including *Lonicera japonica*, *Euonymus fortunei*, *Ligustrum obtusifolium*, and *Celastrus orbiculatus*. These five Old World woody taxa meet the criteria as novel, invasive colonizers by the definition of Davis and Thompson (2000), i.e., they are truly long-distance colonizers aggressively expanding their geographical range and having severe impacts on their environment.

Figure 1. Dead Horse Knob (Rucker' Knob), in Madison County, Kentucky. Pullins-Rucker Cemetery in red-outlined rectangle (not to scale). Map adapted from Google Earth, 2010 DigitalGlobe. Image from January 14, 2004.

METHODS

On September 10, 2010, the Amur Honeysuckle thicket was removed with a chain saw and hand clippers in the cemetery area to expose the flat graveyard headstones (Figure 2A). The eventual intent was to clear the cemetery of all woody plants, except healthy canopy trees, and to build a wooden fence around the cemetery. At the time of brush removal, an inventory of all native and exotic herbaceous and woody taxa observed was recorded. By the following April 14, 2011, the cleared area had been colonized by the invasive *Stellaria media* and a lush regrowth of *Lonicera maackii* from stump sprouts, new subterranean shoots, and emerging seedlings.

On May 17, 2011, an area encompassing 25 x 15 m in the cemetery was carefully cleared of understory Amur Honeysuckle, other woody invaders, and all tree saplings by hand clippers and chain saw. Cut-stumps were then treated with undiluted Tordon® RTU Specialty Herbicide from Dow AgroSciences™. By mid-July 2011, all treated stumps essentially showed a 100% kill from the active ingredients, Picloran (4-amino-3, 5, 6-trichloropicolinic acid) and 2, 4-dichlorophenoxyacetic acid.

Two 20 x 12 m macroplots were laid out with end steel rods and heavy cord twine on August 24 and 25, 2011. The first macroplot boundary (Figure 2A) was placed within the initial 25 x 15 m cleared cemetery (hereafter, cemetery test macroplot). The second macroplot (Figure 3A) was placed in an adjacent dense understory thicket of non-altered *Lonicera maackii* (hereafter, the Amur Honeysuckle reference macroplot).

Thirty 1 x 1 m cemetery test quadrats and 30 (1 x 1 m) Amur Honeysuckle reference quadrats were randomly placed within the two macroplots. Frequency was determined for all living rooted herbaceous and woody plants within the sampling quadrats. This quantitative method was derived from Wu et al. (2002):

$$\text{Frequency} = \frac{\text{Number of quadrats in which a species occurs}}{\text{Total number of quadrats taken}} \times 100$$

Frequency is the proportion of the number of samples (i.e., 1 x 1 m quadrats, n=30 quadrats per macroplot) in which a given species occurs expressed as a percentage. Frequency is a measure of the abundance and distribution of a species within a study area (i.e., 20 x 12 m macroplots, n=2 macroplots). A frequency value gives information to where the species is located and its probability of occurring. After quadrat frequency data were gathered, the two macroplots were completely inventoried for taxa not occurring within the 60 quadrats.

A floristic similarity between macroplots was determined using the strategy of Barbour et al. (1999), whom presented the Sørenson's Community Coefficient (CC) or Index of Similarity (IS) method to determine the degree of floristic congruence between two sites of vegetation based on taxon presence only.

$$\text{Sørenson's Community Coefficient (CC)} = \frac{2 \times (\text{number of species common to both A+B})}{\text{Total species plot A} + \text{Total species plot B}} \times 100$$

An annotated list of taxa in this study was compiled with four relevant attributes: 1) origin (native or exotic), 2) growth duration and habit, 3) macroplot(s) occurrence; and 4) voucher specimen documentation (see Appendix). Nomenclature follows Weakley (2011).

Figure 2. Cemetery test macroplot. (A) After removal of *Lonicera maackii* on September 10, 2010, and (B) secondary successional plant colonization on September 17, 2011.

Figure 3 (A) Margin of the Amur Honeysuckle reference macroplot with a scarcity of plants within the herb layer, and (B) margin of the Cemetery test macroplot with a substantial herb layer. Images were taken on September 17, 2011

RESULTS AND DISCUSSION

Cemetery Test Macroplot.

The 30 cemetery test quadrats contained 51 different species (19 exotics) from 46 genera in 26 families with a total count of 323 individual plants (Table 1). The most important colonizing taxa in the test quadrats with 50% frequency or greater were *Phytolacca americana*, *Oxalis stricta*, *Solanum ptychanthum*, *Erechtites hieractifolius*, *Persicaria longiseta*, and *Ailanthus altissima* (Table 1; Figures 2B & 3B). An additional nine taxa, *Carex blanda*, *Commelina diffusa*, *Eclipta prostrata*, *Chamaesyce maculata*, *Panicum dichotomiflorum*, *Passiflora incarnata*, *Persicaria maculata*, *Smilax bona-nox*, and *Vernonia gigantea*, were collected within the cemetery macroplot but not recorded within the 30 cemetery test quadrats. Thus, a total of 60 taxa were documented for the test macroplot.

Amur Honeysuckle Reference Macroplot.

The 30 Amur Honeysuckle reference quadrats had only 21 species present (seven exotics) from 18 genera in 15 families with a total count of 110 individual plants (Table 2). The most prominent taxa within the reference plot quadrats with at least 50% frequency were *Lonicera maackii* and *L. japonica*. Twenty of 21 taxa in the Amur Honeysuckle quadrats were present in the cemetery quadrats including all seven exotics (Table 3). A single *Acer saccharum* seedling in an Amur Honeysuckle quadrat was not present in the cemetery quadrats (Table 3). No other species were documented outside of the quadrats within this reference macroplot. The herbaceous layer is sparse under the Amur Honeysuckle thicket (Figure 3A).

Floristic Comparisons.

Species richness was substantially higher in the cemetery test macroplot with 60 documented taxa (Table 1) versus only 21 within the Amur Honeysuckle reference macroplot (Table 2). Despite the difference in total taxa for each macroplot, both contained proportionately similar numbers of exotics (cemetery test macroplot = 31.6%, Amur Honeysuckle reference macroplot = 33.3%).

The IS for these two study sites was 55.6% based on quadrat presence only, but 49.4% when the additional collection records outside of the quadrats were included. Any two sites with an IS of 50% or greater are considered to be of the same vegetation type. The biological reality of the two macroplots is best represented by the full floristic composition of both macroplots. Thus, the differences between the two plots were great enough to consider them as significantly different based on species composition.

Species Richness and Origin of Taxa.

The species richness from the two 20 x 12 m macroplots combined was 61 taxa (38 herbs, 23 woody), which included 20 naturalized species (32.79%). The 38 herbaceous taxa comprised 25 annuals/biennials (14 exotics), 12 perennials (one exotic), and one perennial vine. The 23 woody taxa consisted of seven vines (three exotics), four shrubs (two exotics), and 11 trees (one exotic). Fourteen of the 21 naturalized taxa are state-listed by the KY-EPPC (2011). The nine "severe threat" invasive plants are *Ailanthus altissima*, *Carduus nutans*, *Celastrus orbiculatus*, *Euonymus fortunei*, *Ligustrum obtusifolium*, *Lonicera japonica*, *Lonicera maackii*, *Microstegium vimineum*, and *Stellaria media*. Three "significant threat" taxa with invasive characteristics are *Persicaria longiseta*, *Persicaria maculosa*, and *Setaria faberi*, and the two "lesser threat" taxa are *Commelina communis* and *Echinochloa crusgalli* var. *crusgalli*.

Secondary Succession.

Several woody taxa observed after Amur Honeysuckle was cleared from the cemetery on September 10, 2010, included *Euonymus fortunei*, *Ligustrum obtusifolium*, *Lonicera japonica*, *Lonicera maackii*, *Parthenocissus quinquefolia*, *Symphoricarpos orbiculatus*, *Toxicodendron radicans* var. *radicans*, and *Vitis vulpina*. Eight of these nine shrubs and vines were present in

quadrats sampled from both the cemetery macroplot (Table 1) and Amur Honeysuckle macroplot (Tables 2 & 3), except for *Ligustrum obtusifolium* in the cemetery macroplot. Some native and exotic herbaceous and tree seedling volunteers had propagules present in the seed bank (seed pool) before the September 2010 clearing. Seven herbs observed before Amur Honeysuckle removal in 2010 were *Bidens bipinnata*, *Commelina communis*, *Lobelia inflata*, *Oxalis stricta*, *Persicaria longiseta*, *Phytolacca americana*, and *Stellaria media*. These woody and herbaceous taxa invariably had propagules present in the seed bank before removal.

Volunteering taxa with light-weight, wind-carried fruits and seeds were able to quickly colonize the cemetery after Amur Honeysuckle removal (Figures 2B & 3B). Native or exotic herbaceous taxa found in the cemetery quadrats from one growing season included 14 members of Asteraceae (*Ambrosia artemisiifolia*, *Bidens bipinnata*, *Bidens frondosa*, *Carduus nutans*, *Conoclinum coelestinum*, *Conyza canadensis* var. *canadensis*, *Erechtites hieraciifolius*, *Eclipta prostrata*, *Eupatorium serotinum*, *Galinsoga quadriradiata*, *Sonchus asper*, *Taraxacum officinale*, *Verbesina alternifolia*, and *Vernonia gigantea*), seven taxa of Poaceae (*Digitaria ischaemum*, *Digitaria sanguinalis*, *Echinochloa crusgalli* var. *crusgalli*, *Microstegium vimineum*, *Panicum dichotomiflorum*, *Setaria faberi*, and *Setaria pumila*), *Cyperus strigosus*, *Lobelia inflata*, *Oxalis stricta*, *Persicaria longiseta*, *Persicaria maculosa*, *Stellaria media*, and *Verbena urticifolia* var. *urticifolia*, among others (Table 1; Appendix). *Commelina communis*, *Persicaria longiseta*, *Microstegium vimineum*, and *Stellaria media* were annuals with light-weight seeds within the non-altered Amur Honeysuckle reference quadrats (Table 2). Tree seedlings with wind-carried samaras were *Acer rubrum* var. *rubrum*, *Acer saccharum*, *Ailanthus altissima*, and *Fraxinus americana*.

Trees with heavier diaspores distributed by gravity and/or animals (mainly birds and mammals) are *Celtis occidentalis*, *Gleditsia triacanthos*, *Nyssa sylvatica*, *Quercus alba*, *Quercus velutina*, *Prunus serotina* var. *serotina*, and *Robinia pseudoacacia*, while shrubs, woody vines, and perennials with gravity-dispersed and/or animal-dispersed fruits and seeds include *Ligustrum obtusifolium*, *Lonicera japonica*, *Lonicera maackii*, *Parthenocissus quinquefolia*, *Phytolacca americana*, *Rubus pensilvanicus*, *Sambucus canadensis*, *Symphoriocarpos orbiculatus*, *Toxicodendron radicans* var. *radicans*, and *Vitis vulpina*. No state-listed taxa were encountered in the two macroplots (KSNPC 2010).

CONCLUSIONS

Our quantitative floristic frequency data and observations support conclusions in literature that removal of *Lonicera maackii* allows for a large increase in species richness and overall species composition primarily because of increased insolation and decreased competition from Amur Honeysuckle through shade-release. The dense growth habit and allelopathic defenses of this taxon make it a more efficient competitor than many other invasive species and certainly all the native species. As evidenced by the *Lonicera maackii* seedling recruitment in the cemetery test macroplot, reestablishment of another understory thicket of Amur Honeysuckle is eminent in a short time without further control measures. In short, well-known "novel" invasive plant colonizers, such as *Lonicera maackii*, have severely influenced litter decomposition, disturbed soil nutrient cycles, replaced the native flora and vegetation, changed patterns of seedling germination, reproduction, and regeneration, and altered overall secondary plant succession in their respective environments (Poindexter & Thompson 2009).

Although our floristic quantitative study at DHK is determined from only a small sample of quadrat frequency data and personal observations, the density of *Lonicera maackii* has significantly lowered species richness and species diversity of native annual and perennial herbs, shrubs, and tree seedlings to be expected in the Oak-Hickory Forest communities of east-central Kentucky. These deleterious effects are markedly evident when DHK is compared to a pristine area within the Berea

College Forest, the Anglin Falls Ravine in adjoining Rockcastle County, which has very high species richness and is currently without any Amur Honeysuckle-infestation (Thompson & Fleming 2004).

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APPENDIX

The annotated list provides voucher records and selective characteristics of taxa documented in this study. Taxonomic concepts and nomenclature follow Weakley (2011). Exotic taxa are preceded by an asterisk (*) and invasive pest plants for Kentucky (KY-EPPC 2011) are indicated by a double asterisk (**). A plant found in the test macroplot, but not found in quadrats is indicated by a dagger (†). After the scientific name, a vernacular name from either Weakley (2011) or USDA, NRCS (2011) is given. Growth duration (annual, biennial, perennial) and habit (herb, graminoid, herbaceous vine, woody vine, shrub, tree) are designated after the scientific name and are adapted from USDA, NRCS (2011). Habit descriptors are followed by an occurrence designation for each macroplot: CTP = cemetery test plot and ACP = Amur Honeysuckle reference plot. An italicized voucher collection number ends each taxon entry.

ANGIOSPERMS: MONOCOTS

COMMELINACEAE, Spiderwort Family
- ****Commelina communis** L., Asiatic Dayflower. Annual herb; CTP, ACP. *11-650*
- **†*Commelina diffusa** Burmann f., Creeping Dayflower. Annual herb; CTP. *11-652*

CYPERACEAE, Sedge Family
- **†Carex blanda** Dewey, Eastern Woodland Sedge. Perennial graminoid; CTP. *10-354*
- ***Cyperus strigosus*** L., Straw-Colored Flat-Sedge. Perennial graminoid; CTP. *11-651*

POACEAE, Grass Family
- ****Digitaria ischaemum*** (Schreb.) Schreb. ex Muhl., Smooth Crab-Grass. Annual graminoid; CTP. *11-612*
- ****Digitaria sanguinalis*** (L.) Scop., Hairy Crab-Grass. Annual graminoid; CTP. *11-644*
- *****Echinochloa crusgalli*** (L.) P. Beauv. var. *crusgalli*, Barnyard Grass. Annual graminoid; CTP. *11-637*
- *****Microstegium vimineum*** (Trin.) A. Camas, Nepalese Browntop. Annual graminoid; CTP, ACP. *10-941*
- ***†Panicum dichotomiflorum*** Michx., Fall Panic Grass. Annual graminoid; CTP. *11-636*
- *****Setaria faberi*** R.A.W. Herrm., Nodding Foxtail. Annual graminoid; CTP. *11-643*
- ****Setaria pumila*** (Poir.) Roem. & Schult., Annual graminoid; CTP. *11-620*

SMILACACEAE, Greenbrier Family
- ***†Smilax bona-nox*** L., Saw Greenbrier. Woody vine; CTP. *10-1056*

ANGIOSPERMS: DICOTS

ADOXACEAE, Moschatel Family
- ***Sambucus canadensis*** L., Common Elderberry. Shrub; CTP. *10-402*

ANACARDIACEAE, Cashew Family
- ***Toxicodendron radicans*** (L.) Kuntze var. *radicans*, Eastern Poison-Ivy. Woody vine; CTP, ACP. *10-220*

ASTERACEAE, Aster Family
- ***Ambrosia artemisiifolia*** L., Annual Ragweed. Annual herb; CTP. *11-611*
- ***Bidens bipinnata*** L., Spanish Needles. Annual herb; CTP. *11-618*
- ***Bidens frondosa*** L., Devil's Beggar-Ticks. Annual herb; CTP. *11-641*
- *****Carduus nutans*** L., Nodding Musk Thistle. Annual/biennial herb; CTP. *10-424*
- ***Conoclinium coelestinum*** (L.) DC., Blue Mistflower. Perennial herb; CTP. *11-653*

Conyza canadensis (L.) Cronquist var. *canadensis*,
- Canadian Horseweed. Annual herb; CTP. *11-616*
- ***†*Eclipta prostrata*** (L.) L., False Daisy. Annual herb; CTP. *11-529*
- ***Erechtites hieraciifolius*** (L.) Raf. ex DC., Fireweed. Annual herb; CTP. *11-645*
- ***Eupatorium serotinum*** Michx., Late-Flowering Thoroughwort. Perennial herb; CTP. *11-638*
- ****Galinsoga quadriradiata*** Ruiz & Pavón, Shaggy Soldier. Annual herb; CTP. *11-647*
- ****Sonchus asper*** (L.) Hill, Spiny-Leaved Sow-Thistle. Annual herb; CTP. *10-415*
- ****Taraxacum officinale*** F.H. Wiggers, Common Dandelion. Perennial herb; CTP. *10-26*

Verbesina alternifolia (L.) Britton ex Kearney, Common Wingstem. Perennial forb; CTP. *11-642*

†*Vernonia gigantea* (Walter) Trel., Tall Ironweed. Perennial forb; CTP. *11-646*

CANNABINACEAE, Hemp Family

Celtis occidentalis L., Northern Hackberry. Tree; CTP, ACP. *10-394*

CAMPANULACEAE, Bellflower Family

Lobelia inflata L., Indian Tobacco. Annual herb; CTP. *11-639*

CAPRIFOLIACEAE, Honeysuckle Family

******Lonicera japonica* Thunb., Japanese Honeysuckle. Woody vine; CTP, ACP. *10-223*

******Lonicera maackii* (Rupr.) Herder, Amur Honeysuckle. Shrub; CTP, ACP. *10-215*

Symphoricarpos orbiculatus Moench, Indian Currant. Shrub; CTP, ACP. *10-1047*

CARYOPHYLLACEAE, Pink Family

******Stellaria media* (L.) Vill., Common Chickweed. Annual herb; CTP, ACP. *10-24*

CELASTRACEAE, Staff-Tree Family

******Celastrus orbiculatus* Thunb., Oriental Bittersweet. Woody vine; CTP, ACP. *10-805*

******Euonymus fortunei* (Turcz.) Hand.-Mazz., Winter Creeper. Woody vine; CTP, ACP. *10-1049*

EBENACEAE, Ebony Family

Diospyros virginiana L., Common Persimmon. Tree; CTP, ACP. *10-398*

EUPHORBIACEAE, Spurge Family

Acalypha rhomboidea Raf., Common Three-Seeded Mercury. Annual herb; CTP. *11-627*

†*Euphorbia maculata* L., Spotted Sandmat. Annual herb; CTP. *11-640*

FABACEAE, Legume Family

Gleditsia triacanthos L., Honey Locust. Tree; CTP. *11-458*

Robinia pseudoacacia L., Black Locust. Tree; CTP. *11-452*

FAGACEAE, Beech Family

Quercus alba L., White Oak. Tree; CTP, ACP. *10-1034*

Quercus velutina Lam., Black Oak. Tree; CTP, ACP. *10-1041*

NYSSACEAE, Sourgum Family

Nyssa sylvatica Marsh., Blackgum. Tree; CTP. *10-403*

OLEACEAE, Olive Family

Fraxinus americana L., White Ash. Tree; CTP, ACP. *10-1062*

******Ligustrum obtusifolium* Sieb. & Zucc., Border Privet. Shrub; CTP. *10-333*

OXALIDACEAE, Wood-Sorrel Family

Oxalis stricta L., Common Yellow Wood-Sorrel. Perennial herb; CTP. *11-628*

PASSIFLORACEAE, Passion-Flower Family

†*Passiflora incarnata* L., Maypops. Perennial vine; CTP. *11-617*

PHYTOLACCACEAE, Pokeweed Family

Phytolacca americana L., American Pokeweed. Perennial herb; CTP, ACP. *10-868*

POLYGONACEAE, Buckwheat Family

******Persicaria longiseta* (Bruijn) Katagawa, Asiatic Smartweed. Annual herb; CTP, ACP. *10-839*

†*******Persicaria maculosa* A. Gray, Lady's Thumb. Annual herb; CTP. *10-878*

ROSACEAE, Rose Family

Prunus serotina Ehrh. var. *serotina*, Wild Black Cherry. Tree; CTP, ACP. *11-117*

Rubus pensilvanicus Poir., Pennsylvania Blackberry. Perennial herb; CTP, ACP. *11-466*

SAPINDACEAE, Soapberry Family

Acer rubrum L. var. *rubrum*, Red Maple. Tree; CTP, ACP. *10-404*

Acer saccharum Marsh., Sugar Maple. Tree; ACP. *10-192*

SIMAROUBACEAE, Quassia Family

******Ailanthus altissima* (P. Mill.) Swingle, Tree-of-Heaven. Tree; CTP. *10-822*

SOLANACEAE, Nightshade Family

Solanum carolinense L. var. *carolinense*, Horse-Nettle. Perennial herb; CTP. *10-935*

Solanum ptychanthum Dunal ex DC., West Indian Nightshade. Annual herb; CTP. *11-615*

VERBENACEAE, Vervain Family

Verbena urticifolia L. var. *urticifolia*, White Vervain. Perennial herb; CTP. *11-614*

VITACEAE, Grape Family

Parthenocissus quinquefolia (L.) Planch., Virginia Creeper. Woody vine; CTP, ACP. *10-343*

Vitis vulpina L., Frost Grape. Woody vine; CTP, ACP. *10-1053*

Table 1. Frequency from thirty 1 x 1 m quadrats in a 20 x 12 m test macroplot at Dead Horse Knob Cemetery, in Madison County, Kentucky.

Family	Species	Number of Quadrats	Frequency %
Phytolaccaceae	*Phytolacca americana*	29	96.66
Oxalidaceae	*Oxalis stricta*	26	86.66
Solanaceae	*Solanum ptychanthum*	20	66.66
Asteraceae	*Erechtites hieraciifolius*	19	63.33
Polygonaceae	***Persicaria longiseta*	16	53.33
Simaroubaceae	***Ailanthus altissima*	15	50.00
Caprifoliaceae	***Lonicera maackii*	14	46.66
Caprifoliaceae	*Symphoriocarpos orbiculatus*	13	43.33
Vitaceae	*Parthenocissus quinquefolia*	13	43.33
Campanulaceae	*Lobelia inflata*	13	43.33
Fabaceae	*Robinia pseudoacacia*	12	40.00
Vitaceae	*Vitis vulpina*	12	40.00
Caprifoliaceae	***Lonicera japonica*	11	36.66
Caryophyllaceae	***Stellaria media*	9	30.00
Asteraceae	*Ambrosia artemisiifolia*	8	26.66
Asteraceae	*Eupatorium serotinum*	7	23.33
Commelinaceae	***Commelina communis*	7	23.33
Asteraceae	*Bidens bipinnata*	6	20.00
Celastraceae	***Euonymus fortunei*	6	20.00
Rosaceae	*Rubus pensilvanicus*	6	20.00
Poaceae	***Microstegium vimineum*	5	16.66
Anacardiaceae	*Toxicodendron radicans* var. *radicans*	5	16.66
Asteraceae	*Bidens frondosa*	4	13.33
Verbenaceae	*Verbena urticifolia* var. *urticifolia*	4	13.33
Celastraceae	***Celastrus orbiculatus*	3	10.00
Cannabaceae	*Celtis occidentalis*	3	10.00
Asteraceae	*Conyza canadensis* var. *canadensis*	3	10.00
Rosaceae	*Prunus serotina* var. *serotina*	3	10.00
Sapindaceae	*Acer rubrum* var. *rubrum*	2	6.66
Asteraceae	***Cardius nutans*	2	6.66
Poaceae	**Digitaria ischaemum*	2	6.66
Poaceae	**Digitaria sanguinalis*	2	6.66
Nyssaceae	*Nyssa sylvatica*	2	6.66
Poaceae	***Setaria faberi*	2	6.66
Poaceae	**Setaria pumila*	2	6.66
Asteraceae	**Taraxacum officinale*	2	6.66
Euphorbiaceae	*Acalypha rhomboidea*	1	3.33
Ebenaceae	*Diospyros virginiana*	1	3.33
Asteraceae	*Conoclinium coelestinum*	1	3.33
Cyperaceae	*Cyperus strigosus*	1	3.33
Poaceae	***Echinochloa crusgalli* var. *crusgalli*	1	3.33
Asteraceae	**Galinsoga quadriradiata*	1	3.33
Fabaceae	*Gleditsia triacanthos*	1	3.33
Oleaceae	*Fraxinus americana*	1	3.33
Oleaceae	***Ligustrum obtusifolium*	1	3.33
Fagaceae	*Quercus alba*	1	3.33
Fagaceae	*Quercus velutina*	1	3.33
Adoxaceae	*Sambucus canadensis*	1	3.33
Solanaceae	*Solanum carolinense* var. *carolinense*	1	3.33
Asteraceae	**Sonchus asper*	1	3.33
Asteraceae	*Verbesina alternifolia*	1	3.33
TOTALS		26 families, 51 species (19 exotics), 46 genera, 323 plants	

(*)= an exotic taxon, (**)= an invasive pest plant for Kentucky (KY-EPPC 2011).

Table 2. Frequency from thirty 1 x 1 m quadrats in a 20 x 12 m reference macroplot in the Amur Honeysuckle stand adjacent to Dead Horse Knob Cemetery in Madison County, Kentucky.

Family	Species	Number of Quadrats	Frequency %
Caprifoliaceae	***Lonicera maackii*	16	53.33
Caprifoliaceae	***Lonicera japonica*	15	50.00
Caprifoliaceae	*Symphoriocarpos orbiculatus*	10	33.33
Phytolaccaceae	*Phytolacca americana*	10	33.33
Vitaceae	*Parthenocissus quinquefolia*	7	23.33
Rosaceae	*Rubus pensilvanicus*	6	20.00
Anacardiaceae	*Toxicodendron radicans* var. *radicans*	6	20.00
Cannabaceae	*Celtis occidentalis*	5	16.66
Celastraceae	***Euonymus fortunei*	5	16.66
Sapindaceae	*Acer rubrum* var. *rubrum*	4	13.33
Commelinaceae	***Commelina communis*	4	13.33
Rosaceae	*Prunus serotina* var. *serotina*	4	13.33
Vitaceae	*Vitis vulpina*	4	13.33
Poaceae	***Microstegum vimineum*	3	10.00
Caryophyllaceae	***Stellaria media*	3	10.00
Fagaceae	*Quercus alba*	2	6.66
Polygonaceae	***Persicaria longiseta*	2	6.66
Sapindaceae	*Acer saccharum*	1	3.33
Ebenaceae	*Diospyros virginiana*	1	3.33
Fagaceae	*Quercus velutina*	1	3.33
Oleaceae	*Fraxinus americana*	1	3.33
TOTALS	15 families, 21 species (7 exotics), 18 genera, 110 plants		

(*)= an exotic taxon, (**)= an invasive pest plant for Kentucky (KY-EPPC 2011).

Table 3. Floristic composition of two 20 x 12 m macroplots at Dead Horse Knob, in Madison County, Kentucky.

Family	Species	Cemetery Test Plot	Amur Honeysuckle Reference
Euphorbiaceae	*Acalypha rhomboidea*	X	
Sapindaceae	*Acer rubrum var rubrum*	X	X
Sapindaceae	*Acer saccharum*		X
Simaroubaceae	***Ailanthus altissima*	X	
Asteraceae	*Ambrosia artemisiifolia*	X	
Asteraceae	*Bidens bipinnata*	X	
Asteraceae	*Bidens frondosa*	X	
Asteraceae	***Carduus nutans*	X	
Cyperaceae	†*Carex blanda*	X	
Celastraceae	***Celastrus orbiculatus*	X	
Cannabaceae	*Celtis occidentalis*	X	X
Commelinaceae	***Commelina communis*	X	X
Commelinaceae	†**Commelina diffusa*	X	
Asteraceae	*Conoclinium coelestinum*	X	
Asteraceae	*Conyza canadensis* var. *canadensis*	X	
Cyperaceae	*Cyperus strigosus*	X	
Poaceae	**Digitaria ischaemum*	X	
Poaceae	**Digitaria sanguinalis*	X	
Ebenaceae	*Diospyros virginiana*	X	X
Poaceae	***Echinochloa crusgalli* var. *crusgalli*	X	
Asteraceae	†**Eclipta prostrata*	X	
Asteraceae	*Erechtites hieracifolius*	X	
Celastraceae	***Euonymus fortunei*	X	X
Asteraceae	*Eupatorium serotinum*	X	

Euphorbiaceae	†*Euphorbia maculata*	X	
Oleaceae	*Fraxinus americana*	X	X
Asteraceae	**Galinsoga quadriradiata*	X	
Fabaceae	*Gleditsia triacanthos*	X	
Oleaceae	***Ligustrum obtusifolium*	X	
Campanulaceae	*Lobelia inflata*	X	
Caprifoliaceae	***Lonicera japonica*	X	X
Caprifoliaceae	***Lonicera maackii*	X	X
Poaceae	***Microstegium vimineum*	X	X
Nyssaceae	*Nyssa sylvatica*	X	
Oxalidaceae	*Oxalis stricta*	X	
Poaceae	†*Panicum dichotomiflorum*	X	
Vitaceae	*Parthenocissus quinquefolia*	X	X
Passifloraceae	†*Passiflora incarnata*	X	
Polygonaceae	***Persicaria longiseta*	X	X
Polygonaceae	†***Persicaria maculosa*	X	
Phytolaccaceae	*Phytolacca americana*	X	X
Rosaceae	*Prunus serotina* var. *serotina*	X	X
Fagaceae	*Quercus alba*	X	X
Fagaceae	*Quercus velutina*	X	X
Fabaceae	*Robinia pseudoacacia*	X	
Rosaceae	*Rubus pensilvanicus*	X	X
Adoxaceae	*Sambucus canadensis*	X	
Poaceae	***Setaria faberi*	X	
Poaceae	**Setaria pumila*	X	
Smilacaceae	†*Smilax bona-nox*	X	
Solanaceae	*Solanum carolinense* var. *carolinense*	X	
Solanaceae	*Solanum ptychanthum*	X	
Asteraceae	**Sonchus asper*	X	
Caryophyllaceae	***Stellaria media*	X	X
Celastraceae	*Symphoricarpos orbiculatus*	X	X
Asteraceae	**Taraxacum officinale*	X	
Anacardiaceae	*Toxicodendron radicans* var. *radicans*	X	X
Verbenaceae	*Verbena urticifolia* var. *urticifolia*	X	
Asteraceae	*Verbesina alternifolia*	X	
Asteraceae	†*Vernonia gigantea*	X	
Vitaceae	*Vitis vulpina*	X	X
TOTALS	61 taxa	60 taxa	21 taxa
QUADRATS ONLY	52 taxa	51 taxa	21 taxa

(*)= an exotic taxon, (**)= an invasive pest plant for Kentucky (KY-EPPC 2011), (†)=found in macroplot but not in quadrats

Buthod, A.K. and B.W. Hoagland. 2011. New to Oklahoma: *Anthoxanthum odoratum* L. (Poaceae). Phytoneuron 2011-51: 1–2. Published 10 October 2011. ISSN 2153 733X

NEW TO OKLAHOMA: *ANTHOXANTHUM ODORATUM* L. (POACEAE)

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ABSTRACT

This paper documents the occurrence of a vascular plant species previously unknown to the flora of Oklahoma. *Anthoxanthum odoratum* L., a European grass, was discovered in a prairie hay meadow in McIntosh County in east-central Oklahoma and a roadside ditch in Pushmataha County in southeastern Oklahoma.

KEY WORDS: *Anthoxanthum odoratum*, Poaceae, Oklahoma, exotic

Anthoxanthum odoratum L. (Poaceae, Aveneae; sweet vernalgrass) is a perennial grass native to Europe (Pereira et al. 2007). In North America, it has been reported from a majority of states and provinces north of Mexico, including neighboring Colorado, New Mexico, Texas, Arkansas, and Missouri (Kartesz 2011; USDA, NRCS 2011). The first Oklahoma collection (AB-8083) was found in a prairie hay meadow east of Checotah in eastern McIntosh County. A second Oklahoma population (AB-9220) was found in a moist, disturbed ditch in southwestern Pushmataha County. These two collections are the first reports of the species in Oklahoma (Hoagland et al. 2011).

USA. Oklahoma. McIntosh Co.: 2.2 mi E of Checotah on Hwy 266, S side of road; 15S 274377 3927365; T11N R17E Sec. 2, associated species: *Dodecatheon meadia*, *Orbexilum pedunculatum*, *Castilleja purpurea* var. *citrina*, and other native prairie forbs and grasses, 7 May 2009, *Buthod & Hoagland, AB-8083* (OKL). **Pushmataha Co.**: 0.3 mi N of Hwy 3/Indian Nations Turnpike junction just S of McDonalds parking lot; 15 S 255631 3791980; T4S R16E Sec. 5, associated species: *Erigeron tenuis*, *Verbena halei*, and *Cerastium glomeratum*, 13 Apr 2011, *Buthod, AB-9220* (OKL). Figure 1.

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Figure 1. *Anthoxanthum odoratum* from a naturalized population in Pushmataha Co. Oklahoma.

Pruski, J.F. 2011. Compositae of the Guayana Highland-XIV. Four new species of *Calea* (Neurolaeneae) from tepui summits in Venezuela. Phytoneuron 2011-52: 1–9. Published 14 Oct 2011. ISSN 2153 733X

COMPOSITAE OF THE GUAYANA HIGHLAND-XIV. FOUR NEW SPECIES OF *CALEA* (NEUROLAENEAE) FROM TEPUI SUMMITS IN VENEZUELA

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ABSTRACT

Four new species of *Calea* (Neurolaeneae) from the Venezuelan Guayana are described: **Calea coridifolia** Pruski, **Calea granitica** Pruski, **Calea ottohuberi** Pruski, and **Calea venosa** Pruski.

KEY WORDS: Asteraceae, *Calea*, Compositae, Guayana, Heliantheae, Neurolaeneae, tepui, Venezuela.

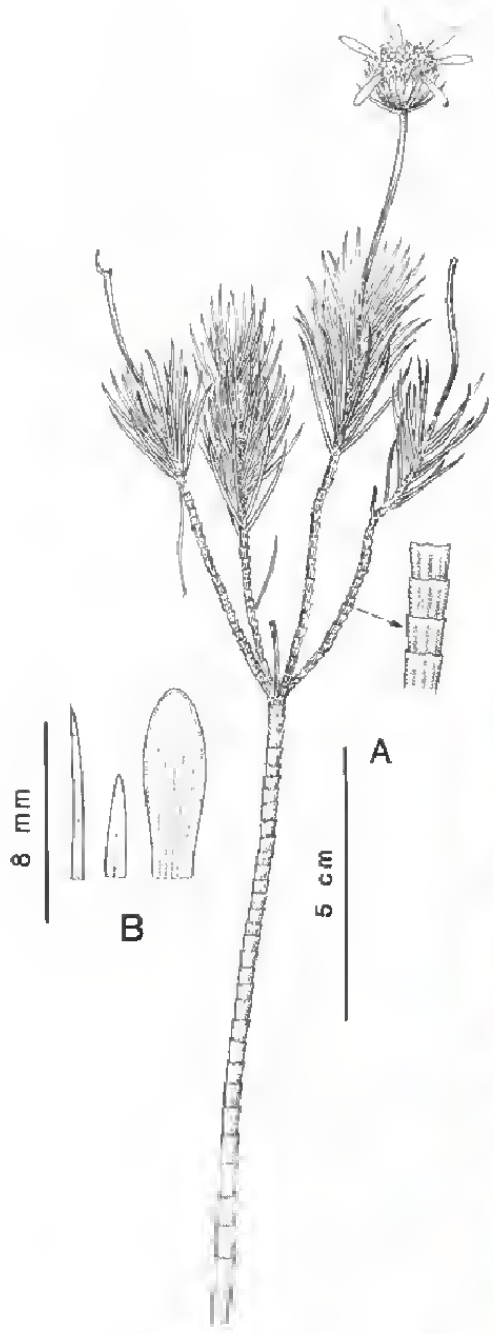
Four new species of *Calea* (Compositae: Neurolaeneae, formerly Heliantheae) from the Venezuelan Guayana are described preliminary to my revision of South American *Calea* L. Materials of the four species were kindly sent to me for determination by Otto Huber. These new species are validated herein so that their names may be used in ecological studies by Dr. Huber, who has begun to distribute duplicates of each of these four novelties.

These new species were listed by Pruski (1997) as *Calea* spp. B-E. At present, "*Calea* sp. A" in Pruski (1997) is known only from imperfect material and appears to represent depauperate plants of *Calea lucidivenia* Gleason & S.F. Blake. Three of the species described below are known only from their respective type collections and are endemic to Amazonas, Venezuela, whereas the fourth is endemic to Sierra de Maigualida, along the border of Edos. Amazonas and Bolívar, Venezuela. Pruski (1997) listed *Calea* and *Mikania* Willd. (Eupatorieae) as the most speciose genera of Venezuelan Guayanan Compositae, each having 27 species reported from the region. Nineteen of the known Venezuelan Guayanan Caleas are endemics, including the four species below, each of which appears to be a narrow endemic.

CALEA CORIDIFOLIA Pruski, sp. nov. Figs. 1, 2. **TYPE: VENEZUELA. Amazonas. Dpto. Atures**: cumbre del Cerro Coro-Coro, en las cabeceras nor-occidentales del Río Manapiare (sector NW de la Serranía Yutajé), 5°46'N, 66°12'W, 2200 m, 12 Nov 1987, *Otto Huber 12320* (holotype: MO!; isotype: VEN!).

Suffruticosa 20–35 cm alta dense foliata; folia sessilia, lamina 1–2.3 cm longa 0.5–1 mm lata univenosa glabra, margo integer, capitulescentia monocephala; pedunculi 1–3 cm longi; capitula radiata 7–9 mm alta 8–10 mm lata; involucrum campanulatum, phyllaria 3-seriata, flosculi radii 6–7, corollis ca. 10.5 mm longis; flosculi disci ca. 15, corollis 3.5–3.8 mm longis; cypselae ca. 3 mm longae; squamae pappo ca. 12, 2.5–3.5 mm longae

Small subshrubs from woody caudex, 20–35 cm tall; stems erect, few-branched, subvirgate, leaves densely inserted in distal 2–10 cm, few-ridged, glabrous, internodes ca. 2 mm long, subequal throughout; herbage glabrous or nearly so. **Leaves** opposite, ascending, sessile; blade linear, 1–2.3 cm long, 0.5–1 mm wide, stiffly chartaceous, green but drying reddish, 1-veined, surfaces eglandular, glabrous, midrib broad abaxially, margins entire, apical mucro stiff, sometimes brownish. **Capitulescence** terminal, monocephalous, capitula subnutant in bud, exserted from the subtending



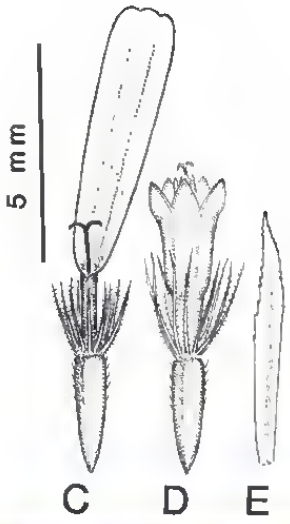


Figure 1. *Calea coridifolia* Pruski. A, habit, with close-up of stem; B, phyllaries; C, ray floret, D, disk floret; E, palea. Drawn from the type collection, *Huber 12320*, by Bruno Manara.

Figure 2. *Calea coridifolia* Pruski. Habit of type collection, *Huber 12320*. Photograph by Otto Huber.

leaves, peduncles 1–3 cm long, pale reddish pre-anthesis. **Capitula** radiate, 7–9 mm tall, 8–10 mm wide, 21–22-flowered, involucre campanulate; phyllaries appressed, 3-seriate, glabrous; outer 5 phyllaries foliar, linear-lanceolate, ca. 6 mm long, ca. 1 mm wide, about as long as the inner phyllaries, evenly and gradually narrowed distally, apex long-attenuate; inner phyllaries oblong, ca. 7

mm long, ca. 2 mm wide, chartaceous, 5–7-striate, drying reddish, apex obtuse; paleae ca. 5.8 mm long, apex acute. **Ray florets** 6–7: corolla ca. 10.5 mm long, yellow, tube ca. 3 mm long, limb obovate, ca. 7.5 mm long, 5-nerved, apex broadly obtuse to nearly truncate, with 3 shallow rounded lobes, abaxially glabrous. **Disk florets** ca. 15; corolla funnelform, 3.5–3.8 mm long, yellow, glabrous, tube ca. 1.2 mm long, throat 1.5–1.8 mm long, lobes ca. 0.8 mm long, style branches ca. 0.7 mm long. **Cypselae** ca. 3 mm long, sparsely setulose distally; pappus scales ca. 12, 2.5–3.5 mm long, subequal, about as long as the cypselae, those of the disks slightly longer.

Distribution and ecology: *Calea coridifolia* occurs in rocky tepui meadows on Cerro Coro-Coro of the Serranía Yutajé at about 2200 meters elevation. It is known to flower in November.

Calea coridifolia, known only from the type collection, is named for its leaves that resemble those of the Mediterranean-centered genus *Coris* L. (Primulaceae). The epithet also alludes to Cerro Coro-Coro, where this strange species is presumably a narrow endemic. Like the geographically near *C. nana* Maguire (Cerro Cuao and Cerro Sipapo, Venezuela), *C. coridifolia* is a small subshrub with radiate capitula, but *C. nana* differs most obviously by its loosely inserted elliptic leaves. *Calea coridifolia* was called "*Calea* sp. C" in Pruski (1997).

CALEA GRANITICA Pruski, sp. nov. Fig. 3. **Type: VENEZUELA. Bolívar. Distrito Cedeño:** Sierra de Maigualida, sector nor-oriental, altiplanicie tepuyana disectada sobre granito en las cabeceras del Río Chajura, afluente occidental del Río Erebato, aprox. 100 Km (en línea recta) al SW del Campamento Entrerios, 5°33'N, 65°13'W, 2100 m, 18 Nov 1988, *Otto Huber & Liz Izquierdo 12821* (holotype: NY!; isotypes: MO!, VEN!).

Suffruticosa vel fruticosa 0.3–2 m alta, folia brevipetiolata, lamina elliptica vel oblonga 1.5–5 cm longa 0.7–3 cm lata subcoriacea triplinervis saepe subtus glandulosa hirsutula, margo paucicrenati-dentatus, capitulescentia monocephala, pedunculi (1–)3–5 cm longi, capitula radiata 10–18 mm alta 15–20 mm lata; involucrum hemisphaericum, phyllaria 3-4-seriata, flosculi radii 11–15, corollis 16.4–21.2 mm longis, flosculi disci ca. 71, corollis 5.5–6 mm longis, cypselae 2.6–3 mm longae, squamae pappo ca. 20, 3.5–4.6 mm longae.

Subshrubs to shrubs, 0.3–2 m tall; stems ascending, moderately-branched, leafy, subhexagonal, pluristriate, hirsutulous or hirsute to glabrate, internodes usually about ½ as long as to nearly as long as leaves. **Leaves** opposite, spreading, short-petiolate; petiole stout, 2–7 mm long, hirsutulous or glabrous; blade elliptic to oblong, 1.5–5 cm long, 0.7–3 cm wide, subcoriaceous, consistently 3-veined from near base, the basal-most pair of strongly arching secondary veins only slightly thicker than the more distal secondaries, distal secondary veins and tertiary veins clearly pinnate-reticulate, raised adaxially, weakly translucent, adaxial surface glabrous, abaxial surface often glandular, also with sparse appressed moniliform trichomes and often sparsely hirsutulous with patent simple trichomes especially on the midrib and near margins, base cuneate to obtuse, margins crenate-dentate distally with 1–3 pairs of apically-directed teeth, apex acute to subobtuse. **Capitulescence** terminal, monocephalous on the several–many lateral branches, typically exserted from the subtending leaves; peduncles (1–)3–5 cm long. **Capitula** radiate, 10–18 mm tall, 15–20 mm wide, 82–86-flowered; involucre hemispherical, double; phyllaries subequal or obgraduate, 3–4-seriate; outer 4 phyllaries ovate, 11–16 mm long, 5–9.5 mm wide, commonly about as long as the inner phyllaries, ascending or slightly spreading, foliar, herbaceous throughout, subcoriaceous, apex acute; inner phyllaries oblong, 7.5–12 mm long, 3–4 mm wide, appressed, chartaceous becoming scarious distally, pluristriatulate, glabrous, apex obtuse to rounded; paleae 6–7 mm long, trifid, apex acuminate. **Ray florets** 11–15; corolla 16.4–21.2 mm long, yellow, tube 2.4–3.2 mm long, limb oblong, 14–18 mm long, 5–7-nerved, apex sometimes irregularly 3-lobed with central lobe to ca. 1 mm long, obtuse to nearly truncate, abaxially glandular. **Disk florets** ca. 71; corolla narrow-funnelform, 5.5–6 mm long, yellow, glabrous, tube 1.4–1.7 mm long, throat longer than lobes, lobes

Figure 3 *Calea granitica* Pruski Photograph of an isotype (*Huber 12821*, MO) showing the double involucre and leaves 3-veined from near the base

1.4–2 mm long; style branches ca. 1.5 mm long. **Cypselae** 2.6–3 mm long, sparsely hirtellous; pappus scales ca. 20, 3.5–4.6 mm long, subequal, longer than the cypselae, reaching to about the base of the disk corolla lobes.

Paratypes: **VENEZUELA. Amazonas. Dpto. Atures:** Sierra Maigualida, NW sector, small valley along an upper tributary of Caño Iguana, 5°30'N, 65°15'W, 2000 m, 28 Feb-3 Mar 1991, *P. Berry, O. Huber & J. Rosales 4894* (NY, U, US); Sierra de Maigualida, sector nor-occidental, cabeceras del Río Iguana, fluente del Río Asita, bosque ribereño y matorrales secundarios sobre vertiente inclinada hacia el SE, 5°43'N, 65°19'W, 1720 m, 25 Mar 1988, *O. Huber 12710* (NY, VEN); Sierra de Maigualida, sector nor-oriental, altiplanicie disectada de granito en las cabeceras nor-orientales del Río Iguana, afluente del Río Ventuari, 5°40'N, 65°08'W, 2150 m, 24 Nov 1989, O. *Huber 13069* (NY, VEN); Cabeceras NW del Río Asita, en el sector NE de la Sierra de Maigualida, 5°31'50"N, 65°09'44"W, 1700 m, 9 Mar 1996, *O. Huber & R. Riina 13652* (MO). **Bolívar. Distrito Cedeño:** Sierra de Maigualida, sector nor-oriental, altiplanicie tepuyana ubicada en las cabeceras del Río Chajura, afluente occidental del Río Erebato, aprox. 100 Km (en línea recta) al SW del Campamento Entreríos, 5°33'N, 65°13'W, 2100 m, 28 Mar 1988, *O. Huber 12734* (NY, VEN).

Distribution and ecology: *Calea granitica* occurs occasionally in tepui meadows, high-tepui forests, and along streams at 1720–2150 meters elevation. *Calea granitica* is endemic to the largely granitic (whence the epithet) Sierra de Maigualida (which may loosely be called a tepui) on the border of Amazonas and Bolívar, Venezuela. It has been collected in flower in February, March, and November.

Calea granitica is a member of the Guayanan *Calea lucidivenia* Gleason & S.F. Blake species group, which is characterized by double involucres with broad foliar outer series of phyllaries and often by subglabrous herbage. *Calea granitica* differs from all members of this group by its short-petiolate subcoriaceous leaves that are consistently 3-veined from near the base. Although most Guayanan collections from past several decades were pressed in EtOH typically destroying diagnostic glandular indumentum and possibly disguising leaf texture, I believe that the leaf venation feature of *C. granitica* holds true.

By its often hirsutulous or hirsute herbage with patent simple trichomes and massive capitula, *Calea granitica* is most similar to *C. tricephala* Maguire (Cerro Parú, Venezuela), which differs by long-petiolate chartaceous leaves that are 3-veined from well above base. Pruski (1997) mentioned that *C. lucidivenia* var. *punctata* Maguire & Wurdack is a possible synonym of *C. tricephala*, but the geographically intermediate *C. granitica* differs in diagnostic characters, albeit these vegetative. *Calea granitica* was given as "*Calea* sp. B" in Pruski (1997).

CALEA OTTOHUBERI Pruski, sp. nov. Fig. 4. **Type: VENEZUELA. Amazonas. Dpto. Atures:** Serranía Uasadi, sector nor-occidental, cumbres montañosas ubicadas en las cabeceras orientales del Río Asita, afluente derecho del Río Ventuari, herbazales y bosquecillos tepuyanos sobre granito, 5°21'N, 65°12'W, 1850 m, 22 Nov 1988, *Otto Huber 12842* (holotype: MO!; isotype: VEN!).

Fruticosa 1–3 m alta, folia petiolata, lamina elliptica 1.5–3.7 cm longa, 0.5–1.2 cm lata chartacea subtriplinervis subtus glandulosa, margo serrulatus; capitulescentia cymosa capitulis saepe 3; pedunculi 1.5–2.5 cm longi; capitula discoidea 8–10 mm alta, 5–7.5 mm lata; involucrum anguste campanulatum; phyllaria ca 4-seriata, flosculi disci 15–18, corollis 5–5.2 mm longis, cypselae 2.6–3 mm longae; squamae pappo ca 18, 4–5 mm longae.

Shrubs, 1–3 m tall; stems ascending, moderately branched, leafy, subhexagonal, costae subglabrous, sulci villosulous-tomentellous, internodes usually about ½ as long as leaves. **Leaves** opposite, spreading, petiolate, petiole to 5 mm long, blade elliptic, 1.5–3.7 cm long, 0.5–1.2 cm wide, chartaceous, drying reddish, pinnately 3-nerved from ca. 5 mm above base, main lateral pair of secondary veins reaching to near distal 1/3 of blade, surfaces sparsely hirsutulous, abaxial surface

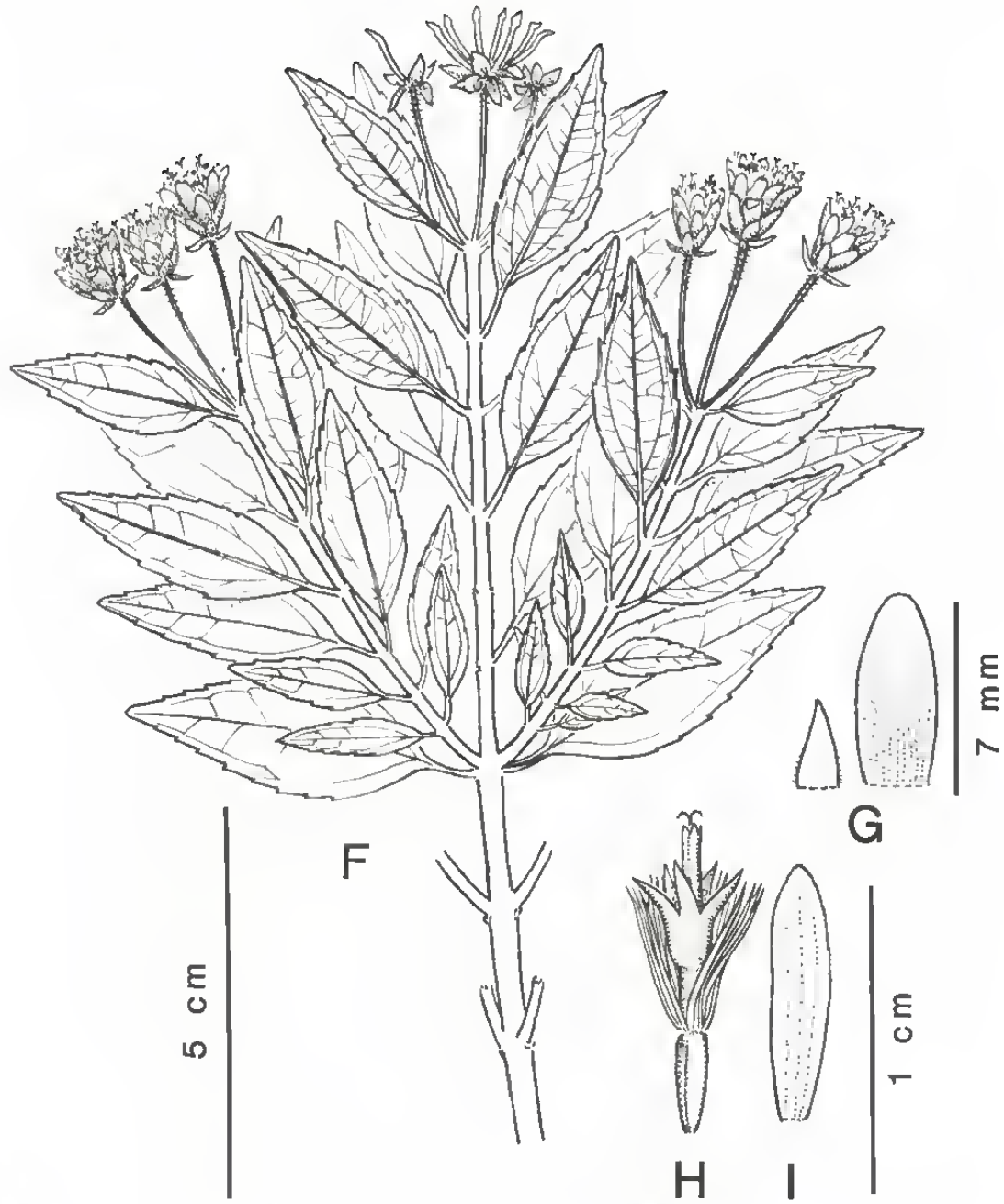


Figure 4. *Calea ottohuberi* Pruski. F, habit; G, phyllaries; H, disk floret; I, palea. Drawn from the type collection, *Huber 12842*, by Bruno Manara.

also glandular, base cuneate, margins serrulate, subrevolute, apex acute to acuminate. **Capitulescence** openly cymose, usually 3-capitulate, capitula obviously pedunculate and held slightly above subtending leaves; peduncles 1.5–2.5 cm long, hirsutulous. **Capitula** discoid, 8–10 mm tall, 5–7.5 mm wide, 15–18-flowered; involucre narrowly campanulate; phyllaries graduated, ca. 4-seriate; outer 2–3 phyllaries broadly lanceolate, ca. 4 mm long, ca. 1.5 mm wide, spreading laterally, subherbaceous, 3-veined, hirsutulous, apex acute; mid-series and inner phyllaries appressed, chartaceous, finely striatulate, glabrous or sometimes merely subglabrous, apex obtuse to rounded; mid-series phyllaries ovate, 3–5 mm long, ca. 3 mm wide, evenly grading to inner phyllaries, these oblong, 7–9 mm long, ca. 3 mm wide; paleae 5.5–6 mm long. **Ray florets** absent. **Disk florets** 15–18; corolla narrowly campanulate, 5–5.2 mm long, yellow, glabrous, tube 1.5–2 mm long, slightly broadened basally, throat and lobes subequal, lobes 1.3–2 mm long; style branches ca. 1 mm long. **Cypselae** 2.6–3 mm long, eglandular, glabrous; pappus scales ca. 18, 4–5 mm long, subequal, longer than cypselae, about as long as corollas.

Distribution and ecology: *Calea ottohuberi* occurs along the border of high-tepui forests with meadows on Serranía Uasadi at about 1850 meters elevation and is known to flower in November.

I am happy to dedicate this new species to my good friend Otto Huber, the world authority of the Flora of the Guayana Highland. Although the genus *Huberopappus* Pruski (Vernonieae) was named for Dr. Huber, this is the first new species I've had the occasion of naming for him.

By its leaf features and discoid capitula, *Calea ottohuberi* seems to be most closely related to *C. abeliodes* S.F. Blake (Guayanan Brazil, Colombia, and Venezuela), which differs by pubescent cypselae and *C. neblinensis* (Maguire & Wurdack) Pruski (Sierra de la Neblina, Venezuela), which differs by its glabrous herbage and glabrous cypselae. *Calea ottohuberi*, known only from the type collection, was given as "*Calea* sp. D" in Pruski (1997).

CALEA VENOSA Pruski, sp. nov. Fig. 5. **TYPE: VENEZUELA. Amazonas. Dpto. Atures:** cumbre del Cerro Coro-Coro, en las cabeceras nor-occidentales del Río Manapiare (sector NW de la Serranía Yutajé), 5°46'N, 66°12'W, 2200 m, 12 Nov 1987, *Otto Huber 12294* (holotype: MO!; isotypes: NY!, VEN!).

Suffruticosa ca. 1 m alta; folia brevipetiolata, lamina orbiculata vel cuneata-obovata 1–1.7 cm longa 0.7–1.8 cm lata subcoriacea pinnatim venosa glandulosa, margo paucicrenati-dentatus, capitulescentia cymosa capitulis saepe 3–6; pedunculi 0.5–1 cm longi; capitula radiata 10–12 mm alta 6–9 mm lata, involucrum anguste campanulatum, phyllaria ca. 4-seriata, flosculi radii 4–5, corollis 9–10 mm longis, limbo glandulifero, flosculi disci 14–18, corollis 5.2–5.7 mm longis, cypselae 3–3.4 mm longae, squamae pappo ca. 16, 4.2–5.5 mm longae.

Subshrubs to shrubs, to ca. 1 m tall; stems ascending, moderately branched, leafy distally, subhexagonal, hirsutulous and glandular, sulcate, internodes usually about ½ as long as leaves. **Leaves** opposite, spreading, short-petiolate; petiole stout, 1–2 mm long, subglabrous; blade orbicular to cuneate-obovate, 1–1.7 cm long, 0.7–1.8 cm wide, subcoriaceous, venation pinnate-reticulate, secondary and tertiary veins prominent, raised adaxially, somewhat translucent, each side with 3–6 larger arching secondary veins with thinner intermediate secondaries, both surfaces glandular, sometimes also sparsely hirtellous with submoniliform trichomes, base cuneate to obtuse, margins crenate-dentate distally with a few apically directed teeth, apex broadly obtuse to nearly truncate. **Capitulescence** cymose, usually 3–6-capitulate; peduncles 0.5–1 cm long, densely hirsutulous, the capitula not exserted from the subtending leaves. **Capitula** radiate, 10–12 mm tall, 6–9 mm wide, 18–23-flowered; involucre narrowly campanulate, somewhat double; phyllaries subequal or

Figure 5. *Calea venosa* Pruski. Photograph of the holotype (*Huber 12294*, MO) showing the prominently veined leaves.

obgraduate, ca. 4-seriate; outer 2–4 phyllaries broadly lanceolate, 8–10 mm long, 2–3 mm wide, about as long as the inner, ascending, herbaceous, subcoriaceous, glandular, apex acute, inserted ca. 1 mm below inner phyllaries; inner phyllaries ovate, 7–8 mm long, 3–4 mm wide, appressed, chartaceous in proximal 2/3, distal 1/3 subherbaceous and glandular, faintly ca. 5-striate, apex obtuse; paleae 6–6.5 mm long, apex obtuse. **Ray florets** 4–5; corolla 9–10 mm long, yellow, tube ca. 3 mm long, limb oblong, 6–7 mm long, 7-nerved, apex obtuse to rounded, glandular abaxially. **Disk florets** 14–18; corolla funnelform, yellow, tube stout, 2.5–2.7 mm long, glandular in distal ½, throat and lobes subequal, lobes 1.3–1.7 mm long; style branches ca. 1 mm long. **Cypselae** 3–3.4 mm long, sparsely setose and glandular distally; pappus scales ca. 16, 4.2–5.5 mm long, subequal, longer than the cypselae, reaching to about the middle of disk corolla lobes.

Distribution and ecology: *Calea venosa* occurs at about 2200 meters elevation among rocks on the summit Cerro Coro-Coro of the Serranía Yutajé and is known to flower in November.

Calea venosa is named for its prominently veined leaves, and is known only from the type collection. By its broad subglabrous leaves, *C. venosa* brings to mind *C. orbiculata* Maguire & Aristeg. (Cerro Coro-Coro and Cerro Yutajé, Venezuela) and *C. punctata* Maguire & Wurdack (Cerro Yutajé, Venezuela), but these tepui summit species differ from *C. venosa* by their fewer and unequal pappus scales and their massive capitula. *Calea venosa* is actually more similar in technical features to species of the *Calea lucidivena* Gleason & S.F. Blake group, with *C. venosa* being unique by the combination of small, orbicular to cuneate-obovate leaves and smaller capitula with an involucre only somewhat double and narrower outer phyllaries. *Calea venosa* was given as *"Calea* sp. E" in Pruski (1997).

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ATLAS OF THE FLORA OF NEW ENGLAND: PAEONIACEAE TO ERICACEAE

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ABSTRACT

Dot maps are provided to depict the distribution at the county level of the taxa of Magnoliophyta: Paeoniaceae to Ericaceae (corresponding to Flora of North America, Vol. 8) growing outside of cultivation in the six New England states of the northeastern United States. The maps treat 147 taxa (species, subspecies, varieties, and hybrids, but not forms) based primarily on specimens in the major herbaria of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut, with most data derived from the holdings of the New England Botanical Club Herbarium (NEBC). Brief synonymy (to account for names used in standard manuals and floras for the area), habitat, chromosome information, and common names are also provided.
KEY WORDS: flora, New England, atlas, distribution, Crassulaceae, Ericaceae, Grossulariaceae, Myrsinaceae, Primulaceae, Saxifragaceae

This article is the seventh in a series (Angelo & Boufford 1996, 1998, 2000, 2007, 2010, 2011a) that will present the distributions of the vascular flora of New England in the form of dot distribution maps at the county level (Figure 1). The atlas is posted on the internet at http://neatlas.org, where it will be updated as new information becomes available.

This project encompasses all vascular plants (lycophytes, pteridophytes and spermatophytes) at the rank of species, subspecies, and variety growing independent of cultivation in the six New England states. Hybrids are also included, but forms and other ranks below the level of variety are not. The dots are based on voucher specimens primarily in New England herbaria (of colleges, universities, botanical gardens, and public museums) representing reproducing populations outside of cultivated habitats. This seventh installment includes the families in Magnoliophyta: Paeoniaceae to Ericaceae corresponding to the families treated in Flora of North America, Vol. 8 (Flora of North America Editorial Committee 2009). Of the 147 taxa treated, 45 are not native to the region. Future accounts will treat the distribution of additional non-monocot angiosperms.

The habitat data are distillations from a variety of sources augmented by our own field observations. An attempt was made to indicate habitat information as it applies to a particular taxon in New England rather than to the entire range of the taxon. Such information is omitted where habitat is not indicated on the specimen label and where we also lack personal knowledge of the plant in New England. Omissions of habitat information are for a few introduced taxa and for all hybrids.

We plan to gather this series of articles, together with additional background material, into a separate volume upon completion of all the installments. It is our hope, in the meantime, that these articles will stimulate additional field work to supplement the distributions portrayed in the maps. The New England Botanical Club herbarium has proven to be the most important resource for this project. We are eager to receive information on voucher specimens in public herbaria documenting range extensions and filling county gaps in distributions. Similarly, because the atlas of the New England flora will be continuously updated as new information becomes available, we are eager to receive notification of published corrections of cytological information and new, documented chromosome counts for taxa in the New England flora.

MATERIALS AND METHODS

Materials and methods are as outlined in Angelo and Boufford (1996) and in a web version (Angelo & Boufford 2011b) and are not repeated here.

TAXONOMY AND FORMAT

The taxonomy and nomenclature adopted for this work essentially follow that of the Flora of North America project, except that families, genera, and species are arranged alphabetically. The families and their circumscription do not necessarily reflect current views on relationships or composition. The Angiosperm Phylogeny Website (Stevens 2001 onwards) should be consulted for a continuously updated treatment of families and their inclusive genera. Named and unnamed hybrid taxa are placed alphabetically at the end of the genus in which they occur. Unnamed hybrids combine the names of the progenitors alphabetically by epithet. Taxa that are not native to New England are indicated by uppercase text. Unpublished names are not used, even if publication is pending.

Chromosome numbers are taken primarily from Flora of North America, Vol. 8 (Flora of North America Editorial Committee 2009) and from Goldblatt and Johnson (1979–).

Synonymy is provided primarily with respect to names accepted in standard manuals covering New England published from 1950 onward, including Fernald (1950), Gleason (1952), Gleason and Cronquist (1991), and Seymour (1982). Synonyms have not been provided where the distribution for the synonymized name does not include New England.

The following list (which includes excluded taxa) will aid readers in finding familiar names that have been transferred to other taxa:

Empetraceae	=>	Ericaceae
Monotropaceae	=>	Ericaceae
Primulaceae (in part)	=>	Myrsinaceae
Primulaceae (in part)	=>	Theophrastaceae
Pyrolaceae	=>	Ericaceae
Saxifragaceae (in part)	=>	Grossulariaceae
Saxifragaceae (in part)	=>	Penthoraceae
Arctostaphylos (in part)	=>	*Arctous*
Cassandra	=>	*Chamaedaphne*
Cassiope (in part)	=>	*Harrimanella*
Chiogenes	=>	*Gaultheria*
Glaux	=>	*Lysimachia*
Ledum	=>	*Rhododendron*
Leucothoë (in part)	=>	*Eubotrys*
Loiseleuria	=>	*Kalmia*
Naumbergia	=>	*Lysimachia*
Oxycoccus	=>	*Vaccinium*
Pyrola (in part)	=>	*Orthilia*
Saxifraga (in part)	=>	*Micranthes*
Sedum (in part)	=>	*Hylotelephium*
Sedum (in part)	=>	*Phedimus*
Sedum (in part)	=>	*Rhodiola*
Tillaea	=>	*Crassula*

The following species have been reported from our area but are excluded for the reasons noted:

Agarista populifolia (Lamarck) Judd [no specimen located; reported from Rhode Island]

Anagallis minima (Linnaeus) E.H.L. Krause (*Centunculus pumilis* (Swartz) Kuntze) [collected in Worcester Co., Massachusetts; no specimens yet accessioned in herbaria that are the basis for this atlas]

Lysimachia quadriflora Sims [no specimen located; reported from Massachusetts with vouchers at MIN, but vouchers not located there]

Pteris floribunda (Pursh) Bentham & Hooker f. [no voucher for wild occurrence found; reported from Vermont]

Primula wilsonii Dunn var. *anisodora* (Balfour f. & Forrest) A. J. Richards (*P. anisodora* Balfour f. & Forrest) [no specimen located; reported from Berkshire Co., Massachusetts; apparently now identified as *Primula japonica* A. Gray]

Rhododendron columbianum (Piper) Harmaja [a single 1871 specimen from Mt. Washington, NH recently annotated as this species, and far from its known range, is excluded until its status in New England is better understood.]

Rhododendron tomentosum Harmaja [a single 1947 specimen from a bog in Carroll Co., NH recently annotated as this species, and distant from its known range, is excluded until its status in New England is better understood.]

Rhododendron vaseyi A. Gray [no voucher for wild occurrence found; reported from Massachusetts]

Saxifraga hyperborea R. Brown [no specimen located; reported from Mount Washington, New Hampshire]

Styrax japonicus Siebold & Zuccarini [no specimen located; reported from Connecticut (Flora of North America Editorial Committee 2009)]

ANGIOSPERMAE (MAGNOLIOPHYTA) - ANGIOSPERMS

CLETHRACEAE

Clethra alnifolia Linnaeus—Sweet Pepperbush (Figure 2). $2n = 16, 32$. Swamps, swampy thickets, damp, sandy woods.

CRASSULACEAE

Crassula aquatica (Linnaeus) Schönland—Common Pigmyweed (Figure 2). $2n = 42$ (Iceland). Tidal mud flats, coastal marshes, pond shores, river margins, vernal pools. [*C. saginoides* (Maximowicz) M. Bywater & Wickens; *Tillaea aquatica* Linnaeus]

HYLOTELEPHIUM ERYTHROSTICTUM (Miquel) H. Ohba—Garden Stonecrop (Figure 2). $2n = 48$. Waste places, disturbed ground, roadsides, pond shores. From eastern Asia, Russia. [*SEDUM ALBOROSEUM* Baker; *S. ERYTHROSTICTUM* Miquel; *S. SPECTABILE* Boreau – misapplied]

HYLOTELEPHIUM SPECTABILE (Boreau) H. Ohba—Butterfly Stonecrop (Figure 2). $2n = 50, 51$. Dry, roadsides. From eastern Asia. [*SEDUM SPECTABILE* Boreau]

HYLOTELEPHIUM TELEPHIUM (Linnaeus) H. Ohba—Witches' Moneybags (Figure 2). 2*n* = 36. Roadsides, waste places, old fields. From northern Eurasia. [*SEDUM TELEPHIUM* Linnaeus; *S. PURPUREUM* (Linnaeus) Schultes]

PHEDIMUS AIZOON (Linnaeus) 't Hart—(Figure 2). 2*n* = 30-32, 56, ca. 64, 66, 71-124. Open, rocky places. From eastern and northern Asia. [*SEDUM AIZOON* Linnaeus]

PHEDIMUS SPURIUS (M. Bieberstein) 't Hart—Caucasian Stonecrop (Figure 2). 2*n* = 28, 42 Rocky or sandy roadsides, waste places, old fields. [*SEDUM SPURIUM* M. Bieberstein; *S. STOLONIFERUM* – misapplied]

Rhodiola rosea Linnaeus—Roseroot (Figure 2). 2*n* = 22. Sea cliffs, rocky ledges. [*Sedum rosea* (Linnaeus) Scopoli]

SEDUM ACRE Linnaeus—Mossy Stonecrop (Figure 2). 2*n* = 40, 60, 80, 100, 120. Rock outcrops, rock walls, dry, open places. From Europe and Greenland.

SEDUM ALBUM Linnaeus—White Stonecrop (Figure 3). 2*n* = 34, 51, 68, 85, 102, 136. Rocky soil. From Europe.

SEDUM HISPANICUM Linnaeus—Spanish Stonecrop (Figure 3). 2*n* = 40. Roadsides, rocky fields. From Eurasia.

SEDUM OCHROLEUCUM Chaix—(Figure 3). 2*n* = 34, 68, 102. Roadsides, rocky fields, waste places. From Europe. [*S. ANOPETALUM* de Candolle]

SEDUM RUPESTRE Linnaeus—Jenny's Stonecrop (Figure 3). 2*n* = 56, 88, 112, 120. Roadsides, waste places. From Europe. [*S. REFLEXUM* Linnaeus]

SEDUM SARMENTOSUM Bunge—Stringy Stonecrop (Figure 3). 2*n* = ca. 72. Roadsides, waste places. From China.

SEDUM SEXANGULARE Linnaeus—Tasteless Stonecrop (Figure 3). 2*n* = 74, 111, 148, 185. Roadsides, waste places. From Europe.

SEDUM TERNATUM Michaux—Wild Stonecrop (Figure 3). 2*n* = 32. Damp roadsides. From farther south or west.

SEMPERVIVUM TECTORUM Linnaeus—Hens-and-chickens (Figure 3). 2*n* = 36, 40, 72. Rocky outcrops, ledges, stone walls, other rocky sites. From Europe.

DIAPENSIACEAE

Diapensia lapponica Linnaeus—Diapensia (Figure 3). 2*n* = 12. Bare, rocky alpine summits or other open, rocky sites at high altitudes.

GALAX URCEOLATA (Poiret) Brummitt—Beetleweed (Figure 4). 2*n* = 6, 12. Steep slopes in shade of trees, oak forests. From farther south and west. [*G. APHYLLA* Linnaeus – misapplied]

EBENACEAE

Diospyros virginiana Linnaeus—Persimmon (Figure 4). 2*n* = 60, 90. Dry woods, old fields.

ERICACEAE

Andromeda polifolia Linnaeus var. *latifolia* Aiton—Bog Rosemary (Figure 4). $2n = 48$. *Sphagnum* bogs. [*A. polifolia* var. *glaucophylla* (Link) de Candolle; *A. glaucophylla* Link]

Arctostaphylos uva-ursi (Linnaeus) Sprengel—Common Bearberry (Figure 4). $2n = 26, 52$. Dry, open, sandy or rocky soils. [*A. uva-ursi* var. *coactilis* Fernald & J. F. Macbride]

Arctous alpina (Linnaeus) Niedenzu—Alpine Bearberry (Figure 4). $2n = 26, 28$. Alpine areas. [*Arctostaphylos alpina* (Linnaeus) Sprengel]

CALLUNA VULGARIS (Linnaeus) Hull—Heather (Figure 4). $2n = 16$. Dry fields, roadsides, damp, sandy sites. From Eurasia.

Chamaedaphne calyculata (Linnaeus) Moench—Leatherleaf (Figure 4). $2n = 22$. Peaty soil of bogs, swamps, pond margins, barrens and swales. [*C. calyculata* var. *angustifolia* (Aiton) Rehder; *C. calyculata* var. *latifolia* (Aiton) Fernald; *Cassandra calyculata* (Linnaeus) D. Don var. *angustifolia* (Aiton) A. Gray; *C. calyculata* var. *latifolia* (Aiton) F. Seymour]

Chimaphila maculata (Linnaeus) Pursh—Spotted Wintergreen (Figure 4). $2n = 26$. Dry woods.

Chimaphila umbellata (Linnaeus) W. P. C. Barton subsp. *umbellata*—Pipsissewa (Figure 4). $2n = 26$. Dry woods. [*C. umbellata* var. *cisatlantica* S. F. Blake]

Corema conradii (Torrey) Torrey—Broom-crowberry (Figure 5). $2n = 26$. Coastal, sandy or rocky soils, pine barrens, exposed, rocky ledges.

Empetrum atropurpureum Fernald & Wiegand—Purple Crowberry (Figure 5). $2n = 52$. Exposed mountain slopes near treeline. [*E. eamesii* Fernald & Wiegand subsp. *atropurpureum* (Fernald & Wiegand) D. Löve; *C. rubrum* Vahl *ex* Willdenow var. *atropurpureum* (Fernald & Wiegand) R. D. Good]

Empetrum nigrum Linnaeus—Black Crowberry (Figure 5). $2n = 26, 39, 52$. Alpine areas.

Epigaea repens Linnaeus—Trailing Arbutus (Figure 5). $2n = 24$. Woods, clearings, in sandy, peaty or rocky soil. [*E. repens* var. *glabrifolia* Fernald]

ERICA CINEREA Linnaeus—Bell Heather (Figure 5). $2n = 24$. Moors, open woods, roadsides. From Europe.

ERICA TETRALIX Linnaeus—Cross-leaved Heath (Figure 5). $2n = 24$. Dry, sandy fields, peaty clearings, roadsides. From Europe.

ERICA VAGANS Linnaeus—Cornish Heath (Figure 5). $2n = 24$. Open, sandy, pine woods. From Europe.

Eubotrys racemosa (Linnaeus) Nuttall—Swamp Sweetbells (Figure 5). $2n = 22$. Swamps, moist thickets, margins of bogs, ponds, and rivers. [*Leucothoë racemosa* (Linnaeus) A. Gray; *Leucothoë racemosa* var. *projecta* Fernald]

Gaultheria hispidula (Linnaeus) Muhlenberg *ex* Bigelow—Creeping Snowberry (Figure 5). 2*n* = 22. *Sphagnum* bogs, mossy coniferous woods and swamps, often on mossy or rotting logs. [*Chiogenes hispidula* (Linnaeus) Torrey & A. Gray]

Gaultheria procumbens Linnaeus—Checkerberry (Figure 6). 2*n* = 44, 88. Dry, acidic woods and clearings.

Gaylussacia baccata (Wangenheim) K. Koch—Black Huckleberry (Figure 6). 2*n* = 24. Dry, open woods, thickets, pastures, ledges.

Gaylussacia bigeloviana (Fernald) Sorrie & Weakley—Bog Huckleberry (Figure 6). 2*n* = 24. *Sphagnum* bogs, *Sphagnum* or *Chamaecyparis* swamps. [*G. dumosa* (Andrews) Torrey & A. Gray var. *bigeloviana* Fernald]

Gaylussacia frondosa (Linnaeus) Torrey & A. Gray—Dangleberry (Figure 6). 2*n* = 24. Dry, woods, thickets.

Harrimanella hypnoides (Linnaeus) Colville—Moss-plant (Figure 6). 2*n* = 32, 48. Mossy alpine or subalpine areas. [*Cassiope hypnoides* Linnaeus) D. Don]

Kalmia angustifolia Linnaeus var. *angustifolia*—Sheep Laurel (Figure 6). 2*n* = 24. Wet or dry, acidic, open soil, *Sphagnum* bogs, rock ledges.

Kalmia latifolia Linnaeus—Mountain Laurel (Figure 6). 2*n* = 24. Acidic, rocky or sandy, deciduous woods, thickets.

Kalmia polifolia Wangenheim—Bog Laurel (Figure 6). 2*n* = 48. *Sphagnum* bogs, exposed, rocky areas at high elevations.

Kalmia procumbens (Linnaeus) Gift & Kron—Alpine Azalea (Figure 6). 2*n* = 24. Alpine areas. [*Loiseleuria procumbens* (Linnaeus) Desvaux]

LEUCOTHOË AXILLARIS (Lamarck) D. Don—Coastal Dog-hobble (Figure 7). Swamps. 2*n* = 22. From farther south.

LEUCOTHOË FONTANESIANA (Steudel) Sleumer—Mountain Dog-hobble (Figure 7). 2*n* = 22. Sandy, pine woods. From farther south.

Lyonia ligustrina (Linnaeus) de Candolle var. *ligustrina*—Maleberry (Figure 7). 2*n* = 24. Swamps, moist thickets, stream and pond margins.

Lyonia mariana (Linnaeus) D. Don—Staggerbush (Figure 7). 2*n* = 24. Open, acidic, pine or oak woods.

Moneses uniflora (Linnaeus) A. Gray—Wood-nymph (Figure 7). 2*n* = 22, 24, 26, 32. Dry, mossy, rich or rocky woods.

Monotropa hypopitys Linnaeus—Pinesap (Figure 7). 2*n* = 48. Leaf mold in woods.

Monotropa uniflora Linnaeus—Indian-pipe (Figure 7). 2*n* = 32, 48. Leaf mold in woods.

Orthilia secunda (Linnaeus) House—One-sided Pyrola (Figure 7). 2*n* = 38. Rich woods. [*Pyrola secunda* Linnaeus; *P. secunda* var. *obtusata* Turczaninow]

OXYDENDRON ARBOREUM (Linnaeus) de Candolle—Sourwood (Figure 7). 2*n* = 24. Woods. From farther south and west

Phyllodoce caerulea (Linnaeus) Babington—Mountain-heath (Figure 8). 2*n* = 24. Alpine rocks and peat.

Pterospora andromeda Nuttall—Pinedrops (Figure 8). 2*n* = 16, 48. Chiefly humus in pine woods, often in basic soil.

Pyrola americana Sweet—Round-leaved Pyrola (Figure 8). 2*n* = 46. Woods. [*P. rotundifolia* Linnaeus var. *americana* (Sweet) Fernald]

Pyrola asarifolia Michaux subsp. *asarifolia*—Pink Pyrola (Figure 8). 2*n* = 46. Rich woods, chiefly calcareous soil. [*P. asarifolia* var. *purpurea* (Bunge) Fernald]

Pyrola chlorantha Swartz—Green Pyrola (Figure 8). 2*n* = 46. Dry woods. [*P. virens* Schweigger var. *virens*; *P. virens* var. *convoluta* (W. P. C. Barton) Fernald]

Pyrola elliptica Nuttall—Shinleaf (Figure 8). 2*n* = 46. Dry woods.

Pyrola minor Linnaeus—Snowline Pyrola (Figure 8). 2*n* = 46. Cold, damp, coniferous or boreal woods.

RHODODENDRON CALENDULACEUM (Michaux) Torrey—Flame Azalea (Figure 8). 2*n* = 52. Roadsides, woods. From farther south and west.

Rhododendron canadense (Linnaeus) Torrey—Rhodora (Figure 8). 2*n* = 52. Bogs, swamps, damp thickets, acid barrens, open, rocky summits and slopes.

RHODODENDRON CATAWBIENSE Michaux—Mountain Rosebay (Figure 9). 2*n* = 26. Low or wet woods. From farther south.

Rhododendron groenlandicum (Oeder) Kron & Judd—Labrador Tea (Figure 9). 2*n* = 26. Peaty soils, especially *Sphagnum* bogs and swamps. [*Ledum groenlandicum* Oeder]

RHODODENDRON JAPONICUM (A. Gray) Suringar—Japanese Azalea (Figure 9). 2*n* = 26. Swampy woods. From Japan.

Rhododendron lapponicum (Linnaeus) Wahlenberg—Lapland Rosebay (Figure 9). 2*n* = 26, 52. Alpine barrens.

Rhododendron maximum Linnaeus—Rosebay (Figure 9). 2*n* = 26. Damp woods, swamp margins.

RHODODENDRON MINUS Michaux var. *MINUS*—Piedmont Rhododendron (Figure 9). 2*n* = 26. Woods. From farther south. [*R. CAROLINIANUM* Rehder]

Rhododendron periclymenoides (Michaux) Shinners—Pinxter-flower (Figure 9). 2*n* = 26. Bogs, swamps, wet woods, thickets. [*R. nudiflorum* (Linnaeus) Torrey – misapplied]

Rhododendron prinophyllum (Small) Millais—Roseshell Azalea (Figure 9). $2n = 26$. Damp thickets, banks of streams, wet or dry, rocky woods. [*R. roseum* (Loiseleur) Rehder – misapplied]

Rhododendron viscosum (Linnaeus) Torrey—Swamp Azalea (Figure 9). $2n = 26$. Swampy thickets, shores, damp clearings.

Vaccinium angustifolium Aiton—Early Lowbush Blueberry (Figure 10). $2n = 48$. Openings, wood borders, old pastures, dry, open barrens, peats, and rocks. [*V. angustifolium* var. *hypolasium* Fernald; *V. angustifolium* var. *laevifolium* House; *V. angustifolium* var. *nigrum* (Alph. Wood) Dole; *V. brittonii* Porter *ex* E. P. Bicknell; *V. lamarckii* Camp]

Vaccinium boreale I. V. Hall & Aalders—Northern Blueberry (Figure 10). $2n = 24$. Alpine heaths and meadows, open, rocky uplands.

Vaccinium caespitosum Michaux—Dwarf Bilberry (Figure 10). $2n = 24$. Alpine and subalpine areas, but also rocky shores at lower elevations.

Vaccinium corymbosum Linnaeus—Highbush Blueberry (Figure 10). $2n = 24, 48, 72$. Swamps, bogs, shores, low woods, dry uplands. [*V. corymbosum* var. *albiflorum* (Hooker) Fernald; *V. corymbosum* var. *glabrum* A. Gray; *V. caesariense* Mackenzie; NOTE: Our treatment differs from *Flora of North America, Volume 8* (Flora of North America Editorial Committee 2009) in that we treat *V. fuscatum* Aiton separately, based on the judgment of some botanists (*e.g.*, Uttal 1987; Ward 1974) and one of us (Boufford).]

Vaccinium fuscatum Aiton—Black Highbush Blueberry (Figure 10). $2n = ?$ Swamps, bogs, low woods. [*V. atrococcum* (A. Gray) A. Heller; See note under preceding taxon.]

Vaccinium macrocarpon Aiton—Large Cranberry (Figure 10). $2n = 24$. Bogs, swamps, wet shores. [*Oxycoccus macrocarpus* (Aiton) Persoon]

Vaccinium myrtilloides Michaux—Velvetleaf Blueberry (Figure 10). $2n = 24$. Margins of woods, thin woods, bogs, clearings.

Vaccinium oxycoccus Linnaeus—Small Cranberry (Figure 10). $2n = 24, 48, 72$. *Sphagnum* bogs. [*V. oxycoccus* var. *ovalifolium* Michaux; *Oxycoccus palustris* Persoon var. *palustris; O. palustris* var. *ovalifolius* (Michaux) F. Seymour]

Vaccinium pallidum Aiton—Late Lowbush Blueberry (Figure 10). $2n = 24, 48$. Dry fields, dry, open woods, clearings. [*V. vacillans* Kalm *ex* Torrey var. *vacillans*; *V. vacillans* var. *crinitum* Fernald]

Vaccinium stamineum Linnaeus—Deerberry (Figure 11). $2n = 24$. Dry, open woods, thickets, clearings.

Vaccinium uliginosum Linnaeus—Alpine Bilberry (Figure 11). $2n = 24, 48, 72$. Rocky or peaty barrens, upper slopes of mountains, alpine thickets. [*V. uliginosum* var. *alpinum* Bigelow]

Vaccinium vitis-idaea Linnaeus—Mountain Cranberry (Figure 11). $2n = 24$. Rocky or dry, peaty soil, chiefly in exposed habitats at higher altitudes. [*V. vitis-idaea* var. *minus* Loddiges, G. Loddiges, & W. Loddiges]

—*Vaccinium* hybrids—

Vaccinium angustifolium Aiton × *V. myrtilloides* Michaux—(Figure 11).

Vaccinium angustifolium Aiton × *V. uliginosum* Linnaeus—(Figure 11).

Vaccinium × *atlanticum* E. P. Bicknell (*pro sp.*)—(Figure 11). [*V. angustifolium* Aiton × *V. corymbosum* Linnaeus]

Vaccinium boreale I. V. Hall & Aalders × *V. myrtilloides* Michaux—(Figure 11).

Vaccinium caespitosum Michaux × *V. myrtilloides* Michaux—(Figure 11).

Vaccinium corymbosum Linnaeus × *V. fuscatum* Aiton—(Figure 11).

Vaccinium corymbosum Linnaeus × *V. myrtilloides* Michaux—(Figure 12).

Vaccinium corymbosum Linnaeus × *V. pallidum* Aiton—(Figure 12).

Vaccinium fuscatum Aiton × *V. pallidum* Aiton—(Figure 12).

GROSSULARIACEAE

Ribes americanum Miller—Wild Black Currant (Figure 12). $2n = 16$. Rich, wet thickets and slopes.

RIBES AUREUM Pursh var. *VILLOSUM* de Candolle—Buffalo Currant (Figure 12). $2n = 16$. Old house sites, roadsides. From farther west. [*R. ODORATUMS* H. L. Wendland]

Ribes cynosbati Linnaeus—Prickly Gooseberry (Figure 12). $2n = 16$. Rich, open, usually moist, woods

Ribes glandulosum Grauer—Skunk Currant (Figure 12). $2n = 16$. Wet woods and clearings.

Ribes hirtellum Michaux—Smooth Gooseberry (Figure 12). $2n = 16$. Rocky woods, swamps. [*R. hirtellum* var. *calcicola* (Fernald) Fernald; *R. hirtellum* var. *saxosum* (Hooker) Fernald]

Ribes lacustre (Persoon) Poiret—Bristly Black Currant (Figure 12). $2n = 16$. Cold woods and swamps.

RIBES MISSOURIENSE Nuttall—Missouri Gooseberry (Figure 13). $2n = 16$. Roadsides. From farther west.

RIBES NIGRUM Linnaeus—Garden Black Currant (Figure 13). $2n = 16$. Thickets, old house sites. From Eurasia.

Ribes rotundifolium Michaux—Appalachian Gooseberry (Figure 13). $2n = ?$ Open rocky places and thickets.

RIBES RUBRUM Linnaeus—Red Garden Currant (Figure 13). $2n = 16$. Old house sites, thickets, riverbanks, open woods, roadsides. From Europe. [*R. sativum* (Reichenbach) Syme]

Ribes triste Pallas—Wild Red Currant (Figure 13). $2n = 16$. Swampy woods, subalpine ravines.

RIBES UVA-CRISPA Linnaeus—European Gooseberry (Figure 13). 2*n* = 16. Fields, roadsides, thickets, woods. From Europe and northern Africa. [*R.GROSSULARIA* Linnaeus]

MYRSINACEAE

ANAGALLIS ARVENSIS Linnaeus—Scarlet Pimpernel (Figure 13). 2*n* = 40. Dry, sandy, waste fields. From Eurasia. [*A. ARVENSIS* var. *CAERULEA* (Linnaeus) Gouan]

Lysimachia ciliata Linnaeus—Fringed Loosestrife (Figure 13). 2*n* = 34, 92, 96, 100, 108, 112. Moist thickets, rich woods and shores, roadsides. [*Steironema ciliatum* (Linnaeus) Baudo]

LYSIMACHIA CLETHROIDES Duby—Gooseneck Loosestrife (Figure 13). 2*n* = 24. Moist meadows, woodland margins, open thickets. From eastern Asia.

Lysimachia hybrida Michaux—Lowland Loosestrife (Figure 14). 2*n* = 34. Swamps, shores.

Lysimachia maritima (Linnaeus) Galasso, Banfi & Soldano—Sea Milkwort (Figure 14). 2*n* = 30, 60. Saline or brackish shores, salt marshes. [*Glaux maritima* Linnaeus var. *maritima*; *G. maritima* var. *obtusifolia* Fernald]

LYSIMACHIA NUMMULARIA Linnaeus—Moneywort (Figure 14). 2*n* = 30, 32, 43 (Europe). Damp roadsides, wet meadows, shores. From Eurasia.

LYSIMACHIA PUNCTATA Linnaeus—Garden Loosestrife (Figure 14). 2*n* = 30. Roadsides, old house sites, waste ground, old fields. From Europe.

Lysimachia quadrifolia Linnaeus—Whorled Loosestrife (Figure 14). 2*n* = 84. Open woods, clearings, roadsides, thickets.

Lysimachia terrestris (Linnaeus) Britton, Sterns & Poggenberg—Swamp Candles (Figure 14). 2*n* = 84. Swamps, shores, low, wet ground, roadside ditches. [*L. terrestris* var. *ovata* (E. L. Rand & Redfield) Fernald]

Lysimachia thyrsiflora Linnaeus—Tufted Loosestrife (Figure 14). 2*n* = 40, 42, 54. Bogs, cold swamps, marshes. [*Naumburgia thyrsiflora* (Linnaeus) Reichenbach]

LYSIMACHIA VULGARIS Linnaeus—Garden Loosestrife (Figure 14). 2*n* = 28, 42, 56, 84 (Europe). Wet roadsides, swampy thickets, waste places, old house sites. From coastal Europe.

—*Lysimachia* hybrids—

Lysimachia × *commixta* Fernald—(Figure 14). [*L. terrestris* (Linnaeus) Britton, Sterns & Poggenberg × *L. thyrsiflora* Linnaeus]

Lysimachia × *producta* Fernald (*pro sp.*)—(Figure 15). Bogs, swamps, open, moist woods, damp thickets, shores. [*L. quadrifolia* Linnaeus × *L.. terrestris* (Linnaeus) Britton, Sterns & Poggenberg]

Trientalis borealis Rafinesque—Starflower (Figure 15). 2*n* = 96. Woods, usually dry.

PAEONIACEAE

PAEONIA LACTIFLORA Pallas—Chinese Peony (Figure 15). 2*n* = 10. Waste places, old house sites. From eastern Asia.

PAEONIA OFFICINALIS Linnaeus—Garden Peony (Figure 15). 2*n* = 20. Old fields and orchards. From Europe.

PENTHORACEAE

Penthorum sedoides Linnaeus—Ditch-stonecrop (Figure 15). 2*n* = 18. Wet, low, open ground, shores, marshes, streambanks.

PRIMULACEAE

ANDROSACE OCCIDENTALIS Pursh—Western Rock-jasmine (Figure 15). 2*n* = 20. Waste places. From farther west.

Hottonia inflata Elliott—American Featherfoil (Figure 15). 2*n* = 22. Muddy ponds, pools, swamps, backwaters of streams.

PRIMULA JAPONICA A. Gray—Japanese Primrose (Figure 15). 2*n* = 44. Wet woods. From Japan. [Including the various cultivars to which this name is applied.]

Primula laurentiana Fernald—Bird's-eye Primrose (Figure 15). 2*n* = 72. Ledges, meadows, shores, chiefly calcareous.

Primula mistassinica Michaux—Dwarf Canadian Primrose (Figure 16). 2*n* = 18. Calcareous cliffs, shores, and meadows.

PRIMULA VERIS Linnaeus—Cowslip (Figure 16). 2*n* = 22 (Europe). Shaded slopes, often in calcareous soil. From Europe. [*P. OFFICINALIS* (Linnaeus) Hill]

SARRACENIACEAE

SARRACENIA FLAVA Linnaeus—Trumpets (Figure 16). 2*n* = 26. Floating *Sphagnum* mats. From farther south.

Sarracenia purpurea Linnaeus subsp. *purpurea*—Common Pitcher-plant (Figure 16). 2*n* = 26. Peaty soil of bogs, swamps and pond margins.

SAXIFRAGACEAE

ASTILBE JAPONICA (C. Morren & Decaisne) A. Gray—False Spiraea (Figure 16). 2*n* = 36. Waste places, roadsides. From Japan.

Chrysosplenium americanum Schweinitz *ex* Hooker—American Golden Saxifrage (Figure 16). 2*n* = 18, 24. Springs, swampy woods, cold, wet places.

Heuchera americana Linnaeus var. *americana*—Rock-geranium (Figure 16). 2*n* = 14. Rich, wet woods.

Micranthes foliolosa (R. Brown) Gornall—Leafy Saxifrage (Figure 16). $2n = 56$. Mossy, alpine rocks. [*Saxifraga stellaris* Linnaeus var. *comosa* Retzius]

Micranthes pensylvanica (Linnaeus) Haworth—Swamp Saxifrage (Figure 16). $2n = 56, 84, 112$. Swamps, wet meadows, boggy thickets. [*Saxifraga pensylvanica* Linnaeus var. *pensylvanica*; *S. pensylvanica* var. *purpuripetala* (A. M. Johnson) Bush]

Micranthes virginiensis (Michaux) Small—Early Saxifrage (Figure 17). $2n = 20$ (+ 0-6 supernumeraries), 38. Open rocky woods, rock outcrops, ledges, rocky hillsides. [*Saxifraga virginiensis* Michaux]

Mitella diphylla Linnaeus—Fairy-cup (Figure 17). $2n = 14$. Rich woods.

Mitella nuda Linnaeus—Naked Miterwort (Figure 17). $2n = 14, 28$. Wet woods, swamps, often in moss. [*M. prostrata* Michaux]

Saxifraga aizoides Linnaeus—Yellow Mountain Saxifrage (Figure 17). $2n = 26$. Calcareous cliffs.

Saxifraga cernua Linnaeus—Nodding Saxifrage (Figure 17). $2n = 24, 36, 48, 52, 56, 60, 70, 72$. Wet ledges at high altitude.

Saxifraga oppositifolia Linnaeus subsp. *oppositifolia*—Purple Mountain Saxifrage (Figure 17). $2n = 26, 39, 48, 52$. Calcareous cliffs.

Saxifraga paniculata Miller—White Mountain Saxifrage (Figure 17). $2n = 28$. Rocky ledges, often calcareous. [*S. aizoön* Jacquin var. *neogaea* Butters]

Saxifraga rivularis Linnaeus subsp. *rivularis*—Alpine Brook Saxifrage (Figure 17). $2n = 52$. Wet, mossy, alpine areas.

Tiarella cordifolia Linnaeus—Foamflower (Figure 17). $2n = 14$. Rich, moist, deciduous woods.

STYRACACEAE

HALESIA CAROLINA Linnaeus—Carolina Silverbell (Figure 18). $2n = 24$. Moist, deciduous woods, roadsides. From farther south and west. [*H. tetraptera* J. Ellis]

SYMPLOCACEAE

SYMPLOCOS PANICULATA Miquel—Sapphire-berry (Figure 18). $2n = 22$. Swamp margins. From Asia.

THEOPHRASTACEAE

Samolus parviflorus Rafinesque—Seaside Brookweed (Figure 18). $2n = 26$. Tidal shores, wet places. [*S. floribundus* Kunth]

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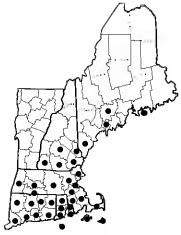
Figure 1 Key map for counties of the New England states (and Mt Desert Island, Maine; Block Island, Rhode Island; arbitrary divisions of larger Maine counties and of Coös County, New Hampshire)



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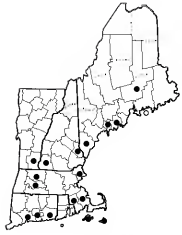

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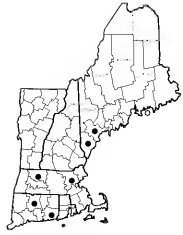

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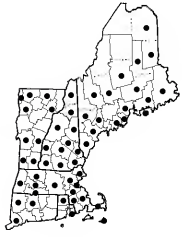

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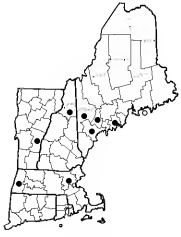
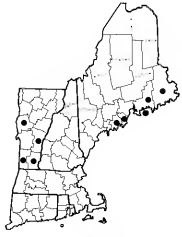
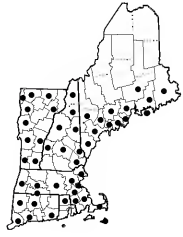


PHEDIMUS SPURIUS

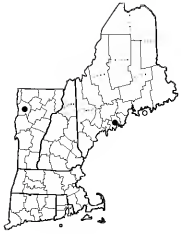


Rhodiola rosea



SEDUM ACRE

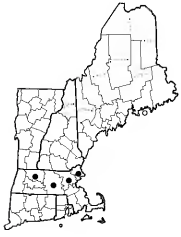
Figure 2 Distribution maps



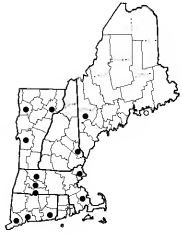
SEDUM ALBUM

SEDUM HISPANICUM

SEDUM OCHROLEUCUM

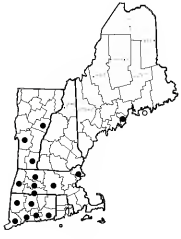


SEDUM RUPESTRE

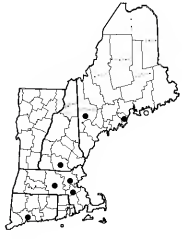


SEDUM SARMENTOSUM

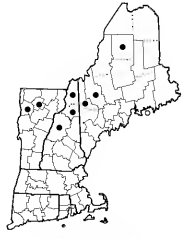
SEDUM SEXANGULARE



Sedum ternatum

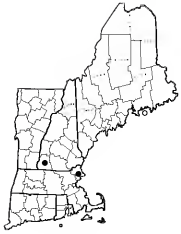


SEMPERVIVUM TECTORUM



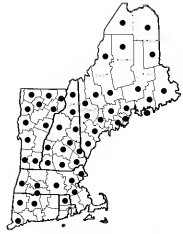
Diapensia lapponica

Figure 3 Distribution maps.

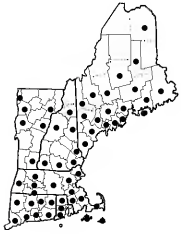


GALAX URCEOLATA

Diospyros virginiana

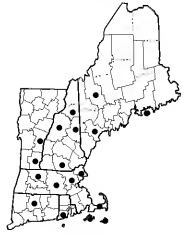


Andromeda polifolia var. *latifolia*

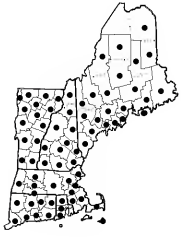


Arctostaphylos uva-ursi

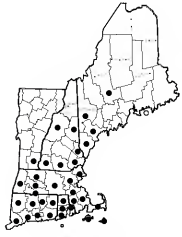
Arctous alpina



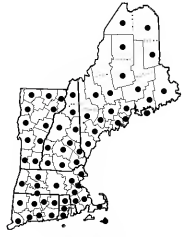
CALLUNA VULGARIS



Chamaedaphne calyculata

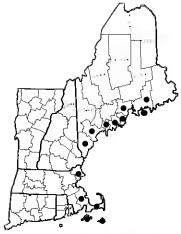


Chimaphila maculata

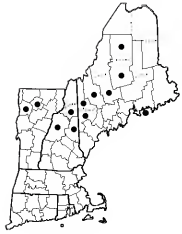


Chimaphila umbellata subsp. *umbellata*

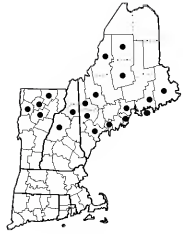
Figure 4 Distribution maps.



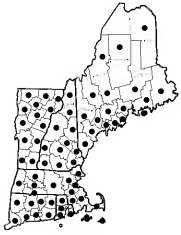
Corema conradii



Empetrum atropurpureum



Empetrum nigrum



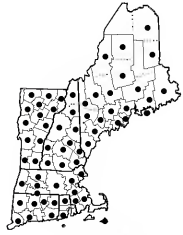
Epigaea repens

ERICA CINEREA

ERICA TETRALIX

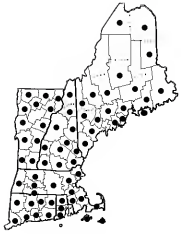
ERICA VAGANS

Eubotrys racemosa

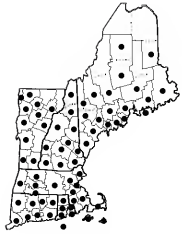


Gaultheria hispidula

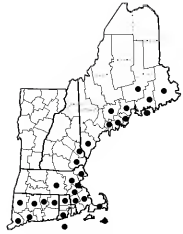
Figure 5 Distribution maps.



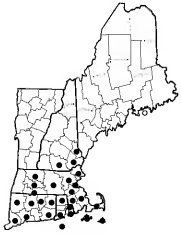
Gaultheria procumbens



Gaylussacia baccata

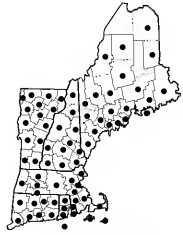


Gaylussacia bigeloviana

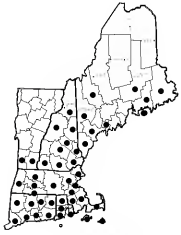


Gaylussacia frondosa

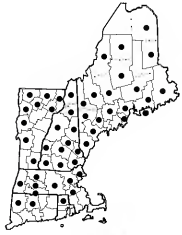
Harrimanella hypnoides



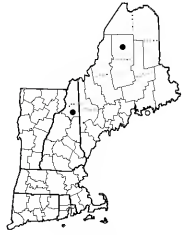
Kalmia angustifolia
var. *angustifolia*



Kalmia latifolia



Kalmia polifolia

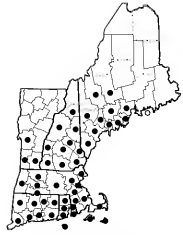


Kalmia procumbens

Figure 6 Distribution maps.

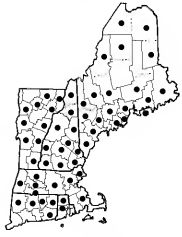
LEUCOTHOË AXILLARIS

LEUCOTHOË FONTANESIANA

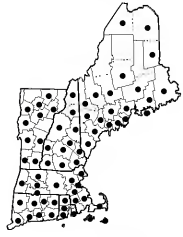


Lyonia ligustrina subsp. *ligustrina*

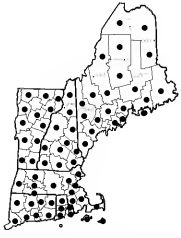
Lyonia mariana



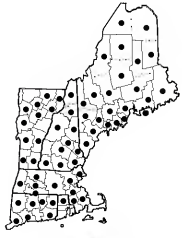
Moneses uniflora



Monotropo hypopitys



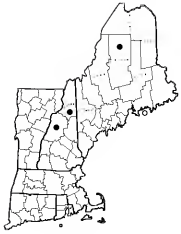
Monotropa uniflora



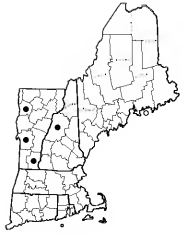
Orthilia secunda

OXYDENDRUM ARBOREUM

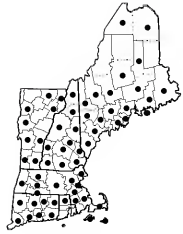
Figure 7 Distribution maps



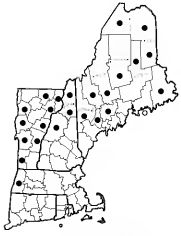
Phyllodoce caerulea



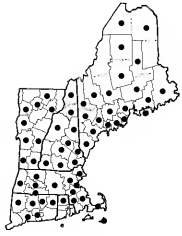
Pterospora andromeda



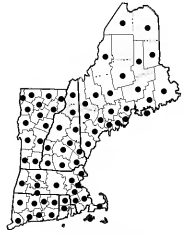
Pyrola americana



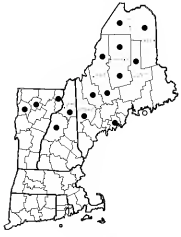
Pyrola asarifolia subsp. *asarifolia*



Pyrola chlorantha

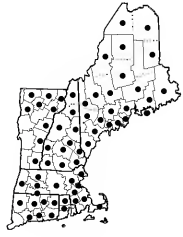


Pyrola elliptica



Pyrola minor

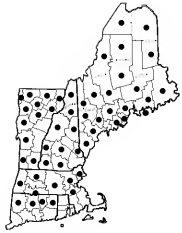
RHODODENDRON CALENDULACEUM



Rhododendron canadense

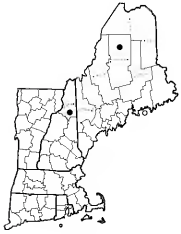
Figure 8 Distribution maps.

RHODODENDRON CATAWBIENSE

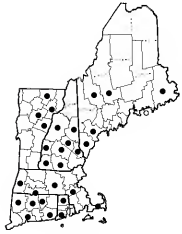


Rhododendron groenlandicum

RHODODENDRON JAPONICUM



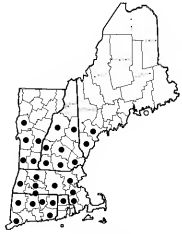
Rhododendron lapponicum



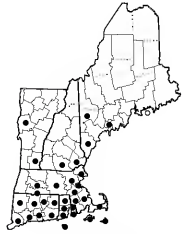
Rhododendron maximum

RHODODENDRON MINUS
var. *MINUS*

Rhododendron periclymenoides

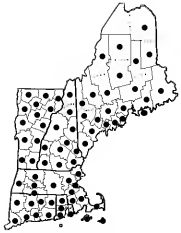


Rhododendron prinophyllum

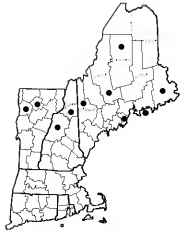


Rhododendron viscosum

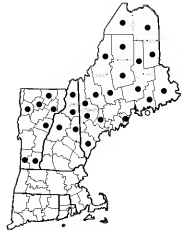
Figure 9 Distribution maps.



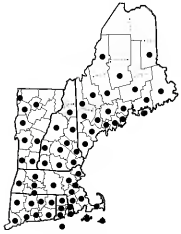
Vaccinium angustifolium



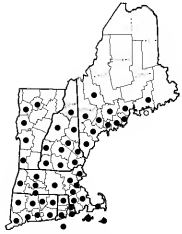
Vaccinium boreale



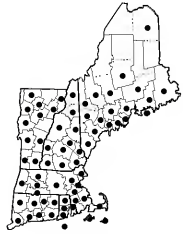
Vaccinium caespitosum



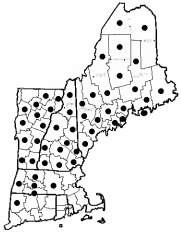
Vaccinium corymbosum



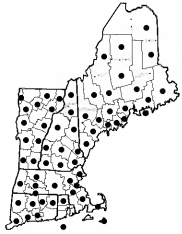
Vaccinium fuscatum



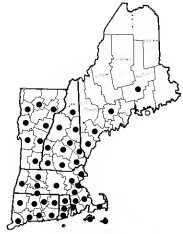
Vaccinium macrocarpon



Vaccinium myrtilloides

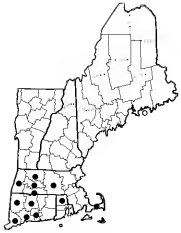


Vaccinium oxycoccus

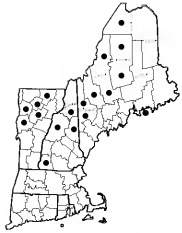


Vaccinium pallidum

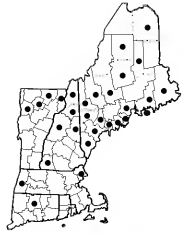
Figure 10. Distribution maps



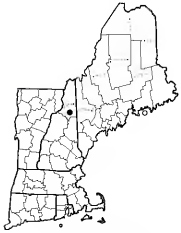
Vaccinium stamineum



Vaccinium uliginosum

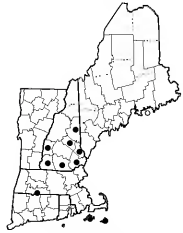


Vaccinium vitis-idaea



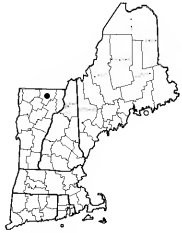
Vaccinium angustifolium
X *V. myrtilloides*

Vaccinium angustifolium
X *V. uliginosum*



Vaccinium X *atlanticum*

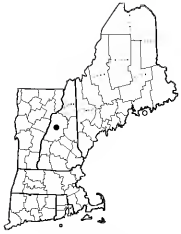
Vaccinium boreale
X *V. myrtilloides*



Vaccinium caespitosum
X *V. myrtilloides*

Vaccinium corymbosum
X *V. fuscatum*

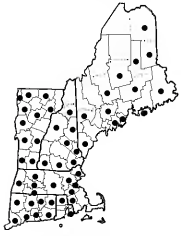
Figure 11. Distribution maps.



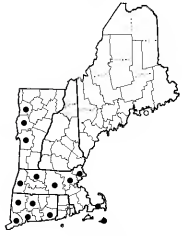
Vaccinium corymbosum
X *V. myrtilloides*

Vaccinium corymbosum
X *V. pallidum*

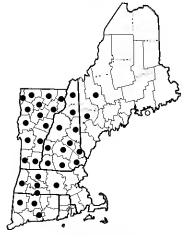
Vaccinium fuscatum
X *V. pallidum*



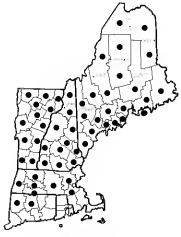
Ribes americanum



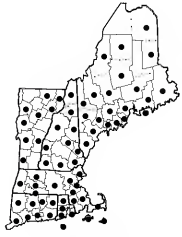
RIBES AUREUM
var *VILLOSUM*



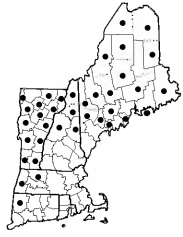
Ribes cynosbati



Ribes glandulosum

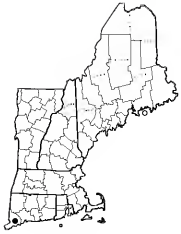


Ribes hirtellum

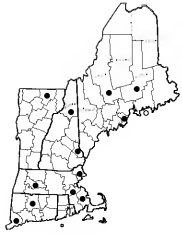


Ribes lacustre

Figure 12. Distribution maps

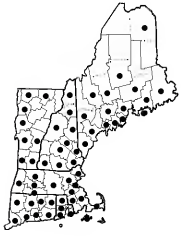


RIBES MISSOURIENSE

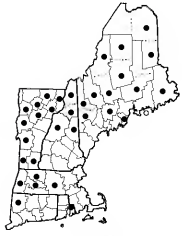


RIBES NIGRUM

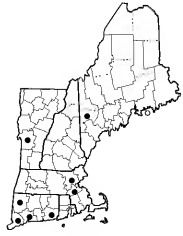
Ribes rotundifolium



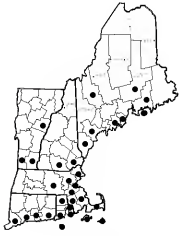
RIBES RUBRUM



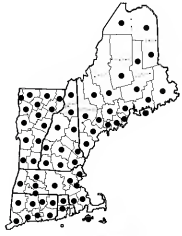
Ribes triste



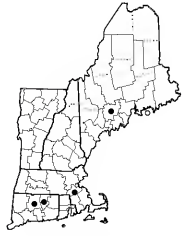
RIBES UVA-CRISPA



ANAGALLIS ARVENSIS

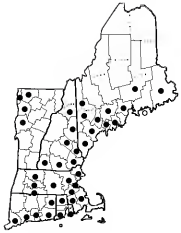


Lysimachia ciliata

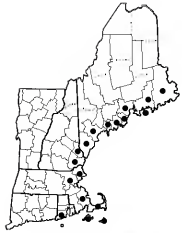


LYSIMACHIA CLETHROIDES

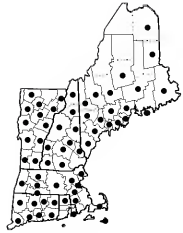
Figure 13. Distribution maps.



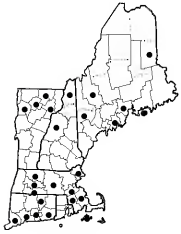
Lysimachia hybrida



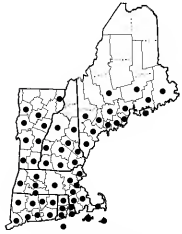
Lysimachia maritima



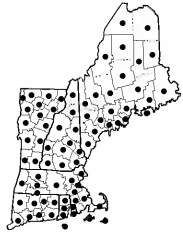
LYSIMACHIA NUMMULARIA



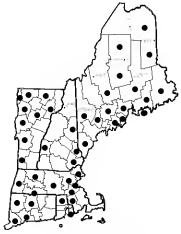
LYSIMACHIA PUNCTATA



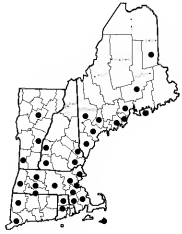
Lysimachia quadrifolia



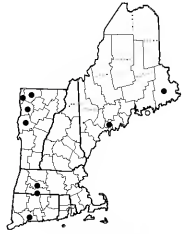
Lysimachia terrestris



Lysimachia thyrsiflora

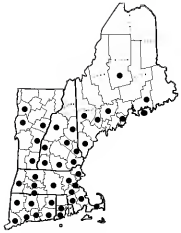


LYSIMACHIA VULGARIS

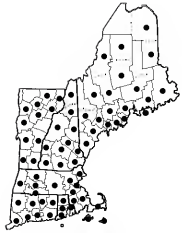


Lysimachia X commixta

Figure 14. Distribution maps

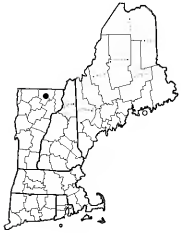


Lysimachia X producta

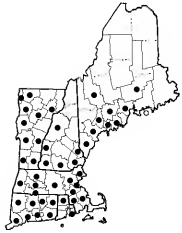


Trientalis borealis

PAEONIA LACTIFLORA

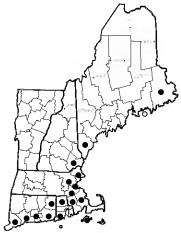


PAEONIA OFFICINALIS



Penthorum sedoides

ANDROSACE OCCIDENTALIS

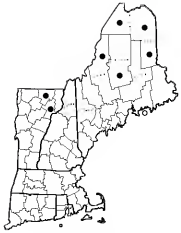


Hottonia inflata

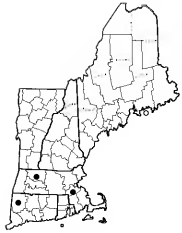
PRIMULA JAPONICA

Primula laurentiana

Figure 15. Distribution maps.

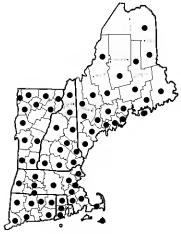


Primula mistassinica



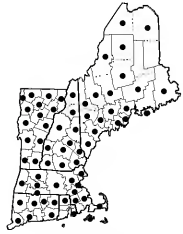
PRIMULA VERIS

SARRACENIA FLAVA



Sarracenia purpurea
subsp *purpurea*

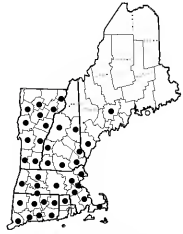
ASTILBE JAPONICA



Chrysosplenium americanum

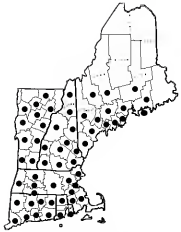
Heuchera americana
var *americana*

Micranthes foliolosa

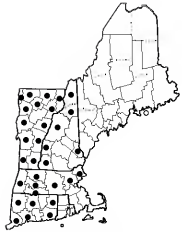


Micranthes pensylvanica

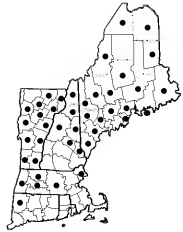
Figure 16. Distribution maps



Micranthes virginiensis



Mitella diphylla

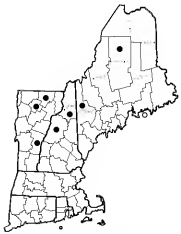


Mitella nuda

Saxifraga aizoides

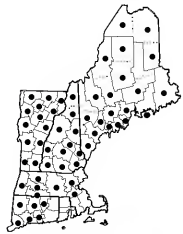
Saxifraga cernua

Saxifraga oppositifolia
subsp *oppositifolia*



Saxifraga paniculata

Saxifraga rivularis
subsp *rivularis*

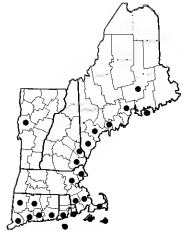


Tiarella cordifolia

Figure 17. Distribution maps.

HALESIA CAROLINA

SYMPLOCOS PANICULATA



Samolus parviflorus

Figure 18. Distribution maps.

MacRoberts, M.H. and B.R. MacRoberts. 2011. *Desmanthus virgatus* (Fabaceae): New to Louisiana. Phytoneuron 2011-54: 1–3. Published 1 November 2011. ISSN 2153 733X

DESMANTHUS VIRGATUS (FABACEAE): NEW TO LOUISIANA

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ABSTRACT

Desmanthus virgatus (L.) Willd. is documented as occurring in Caddo Parish, Louisiana, outside of its native range, and is considered to be naturalized.
KEY WORDS: *Desmanthus virgatus*, naturalized, Fabaceae, Louisiana.

We recently discovered a population of *Desmanthus virgatus* (L.) Willd., also known as Wild Tantan, in a vacant lot in Shreveport, Louisiana (Figs. 1, 2) and report it here as the first known occurrence of the species in the state.

Voucher. **Louisiana**. Caddo Parish: Shreveport, vacant lot at Line Avenue and Tree Lane, 32° 27' 09.23" N, 93° 44' 45.42" W, ca. 53 meters elevation, 14 Sep 2011, *MacRoberts & MacRoberts 8919* (LSU, LSUS, TEX).

The native range of *Desmanthus virgatus* is south Texas, Florida, Mexico, Central America, South America, and the Caribbean (Turner et al. 2003; Kartesz & Meacham 2005; NatureServe 2011; USDA Plants 2011; Tropical Forages 2011). The closest known location of the species to the Louisiana locality is Robertson Co., Texas (Turner et al. 2003) about 320 km southwest. Whether the species has been brought into this area by human activity or is spreading eastward because of climate warming is a matter of conjecture (Chen et al. 2011). It is apparently widely used in agronomy as a food plant for grazing ruminants and has been introduced around the world.

The location where *Desmanthus virgatus* was found is a vacant lot, which in our memory has never had a building on it. Dozens of *D. virgatus* plants were concentrated in an open area (ca. 50 square meters) mainly between sidewalk and street where they sprawled across the sidewalk and grew over the gutter into the street. The area is occasionally mowed, which may have assisted the species because of its sprawling and procumbent habit. Associated species include *Cenchrus incertus*, *Cynodon dactylon*, and *Paspalum notatum*.

According to D.T. MacRoberts (1984, 1989), Riddell (1852: 748) listed *Desmanthus virgatus* as *Darlingtonia glandulosa* DC. for Louisiana but MacRoberts considered the report questionable, presumably because there appeared to be no voucher or if there is, its whereabouts is unknown. Thomas and Allen (1998) excluded the Riddell report of *Desmanthus virgatus* from Louisiana because a specimen could not be located in the state herbaria. We have not found a record of the specimen in searches of online databases. Unfortunately, the fate of Riddell's specimens is not known in any detail and many have been scattered among various herbaria both in the United States and Europe (Ewan 2005).

ACKNOWLEDGEMENTS

Billie Turner confirmed our initial identification of the *Desmanthus*. Amanda Lewis helped with the figures.

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Figure 1. *Desmanthus virgatus*, sprawling over culvert cover in Shreveport, Louisiana

Figure 2. *Desmanthus virgatus*, details of Shreveport plants.

Buthod, A.K. and B.W. Hoagland. 2011. New to Oklahoma: *Leptochloa panicoides* (Poaceae). Phytoneuron 2011-55: 1–2.
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NEW TO OKLAHOMA: *LEPTOCHLOA PANICOIDES* (POACEAE)

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ABSTRACT

This paper documents the occurrence of a vascular plant species previously unknown to the flora of Oklahoma. *Leptochloa panicoides* (J. Presl) Hitchc., a grass of the tribe Eragrostideae, was discovered in wetland habitats in Le Flore and McCurtain counties in southeastern Oklahoma.
KEY WORDS: *Leptochloa panicoides*, Poaceae, Eragrostideae, Oklahoma

Leptochloa panicoides (J. Presl) Hitchc. (Poaceae, Eragrostideae; Amazon sprangletop) is an annual grass found in bottomlands, ditches, and other moist disturbed areas (Yatskievych 1999). In the USA it has been reported from Alabama, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Tennessee, Puerto Rico, Virginia, and the neighboring states of Arkansas, Missouri, and Texas (Kartesz 2011; USDA, NRCS 2011). Once considered to be a Brazilian introduction, the taxa is now treated as a native (Snow 2003). The first Oklahoma collections (RS-189 and RS-248) were found at the margin of a man-made lake in McCurtain County. Associated species included *Thalia dealbata* and *Sagittaria montevidensis*. A second population (NWCA11-5918-5) was found in a wetland in Le Flore County. Associated species included *Carex crus-corvi* and *Salix nigra*. These three collections are the first reports of the species in the state of Oklahoma (Hoagland et al. 2011).

Voucher collections. **Oklahoma**. McCurtain Co.: W of Harris at the Red Slough Wildlife Management Area, Unit 30E, 33.73231° -94.64319°; T9S R25E Sec. 36; 19 Aug 2010, *Buthod & Hoagland RS-189* (OKL) and 16 Sep 2010, *Buthod & Hoagland RS-248* (OKL). Le Flore Co.: ca. 1.2 mi S and 1.3 mi W of Redland, 35.28600° -94.65407°; T9N R25E Sec. 3; 11 Aug 2011, *Hoagland & Messick NWCA11-5918-5* (OKL). Figure 1.

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Figure 1. *Leptochloa panicoides* from Le Flore County, Oklahoma

Buthod, A.K. New to Oklahoma: *Isolepis pseudosetacea* (Cyperaceae). Phytoneuron 2011-56: 1–2. Published 8 November 2011. ISSN 2153 733X

NEW TO OKLAHOMA: *ISOLEPIS PSEUDOSETACEA* (CYPERACEAE)

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ABSTRACT

This paper documents the occurrence of a vascular plant species previously unknown to the flora of Oklahoma. *Isolepis pseudosetacea* (Daveau) Gandoger was discovered in a disturbed area in Pushmataha County in southeastern Oklahoma.

KEY WORDS: *Isolepis pseudosetacea*, Cyperaceae, Oklahoma

Isolepis pseudosetacea (Daveau) Gandoger (Cyperaceae; Gulf Coast bulrush) is an annual member of the Cyperaceae found in wet and drying areas in grasslands, open woodlands, and disturbed areas (Smith 2002). In the USA it has been reported from Alabama, Georgia, Louisiana, Mississippi, and the neighboring states of Arkansas, Missouri, and Texas (Kartesz 2011; USDA, NRCS 2011). *Isolepis pseudosetacea* differs from the more common *I. carinata* in scale and achene length; both are shorter in *I. pseudosetacea*. The collection described below was found in a moist disturbed area with *Anthoxanthum odoratum*, *Houstonia micrantha*, and *Mimuartia patula*. This collection is the first report of the species in the state of Oklahoma (Hoagland et al. 2011).

Voucher collection. **Oklahoma**. Pushmataha Co.: 0.3 mi N of Hwy 3/Indian Nations Turnpike junction just S of McDonald's parking lot; 15 S 255631 3791980; T4S R16E Sec. 5, 13 Apr 2011, *Buthod AB-9250* (OKL). Figure 1.

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Figure 1. *Isolepis pseudosetacea* from Pushmataha County, Oklahoma.

Gandhi, K.N., M.A. Vincent & J.L. Reveal. 2011. *Dermatophyllum*, the correct name for *Calia* (Fabaceae). Phytoneuron 2011-57: 1–4. Mailed 29 November 2011. ISSN 2153 733X

DERMATOPHYLLUM, THE CORRECT NAME FOR *CALIA* (FABACEAE)

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ABSTRACT

The generic name *Dermatophyllum* Scheele (1848) is recognized as the correct name for what have been known as *Calia* Terán & Berland. (1832; non *Calea* L. (1763) and *Agastianis* Raf. (1838), *nom. illeg.* Five new combinations are required: **Dermatophyllum arizonicum**, **Dermatophyllum gypsophilum**, **Dermatophyllum gypsophilum** subsp. **guadalupense**, **Dermatophyllum secundiflorum**, and **Dermatophyllum purpusii**.

KEY WORDS: *Agastianis*, *Calea*, Asteraceae, *Calia*, *Dermatophyllum*, Fabaceae southwestern USA, Mexico

The genus *Dermatophyllum* Scheele was erected in 1848 with a single species, *D. speciosum* Scheele. This genus is being recognized here as a segregate of the larger, paraphyletic genus *Sophora*, comprising *Sophora* sect. *Calia* (Terán & Berland.) Rudd (Rudd 1972) (= *Sophora* sections *Arizoniatae* Tsoong and *Agastianis* (Raf.) Tsoong [Tsoong & Ma 1981]). It is considered distinct from *Sophora sensu stricto* by the following suite of characters: woody habit; thick, coriaceous leaflets; blue, violet or white flowers; calyx with obvious teeth or lobes; flattened to terete legumes; and a geographically restricted range. This distinction is supported by molecular data (Heenan et al. 2004; Lewis et al. 2005; Pennington et al. 2001; Wojciechowski et al. 2004), where *Calia* falls into a separate clade from *Styphnolobium* and other *Sophora* species. Four species are being recognized in *Dermatophyllum*, a genus ranging from the southwestern USA (Arizona, New Mexico, Texas) south into México (Chihuahua, Coahuila, Hidalgo, Nuevo León, Oaxaca, San Luis Potosí, Sonora, Tamaulipas, Zacatecas). Resurrection of this generic name followed a debate about the availability of *Calia* Terán & Berland. for this genus.

In early 2010, a question on the status of the parahomonyms *Calea* L. (1763; Asteraceae) and *Calia* Terán & Berland. (1832; Fabaceae) was submitted to the Nomenclature Committee for Vascular Plants for a ruling whether these two generic names are confusable. By a majority vote, the Committee concluded that these two names are confusable and that *Calia* is to be treated as a later homonym (Brummitt, 2011: 231–232). The Committee's voting was approved by the Eighteenth International Botanical Congress, held at Melbourne, Australia, in July 2011.

One reason for this matter being so long overlooked is that *Calea*, a large genus with some 110 species, is confined to warm parts of America (Mabberley 2008). On the other hand, *Calia* is a genus of four species and was long considered to be a synonym of *Sophora* L. until Yakovlev (1967) resurrected the name. Three recent works accept *Calia* (Sousa & Rudd 1993; Lewis & al. 2005; Mabberley 2008). Furthermore, Wojciechowski et al. (2004) placed *Calia* in its own clade and demonstrated its distinctiveness from *Sophora*. In fact, USDA-GRIN (2011) lists two of the five species to be economically important in the USA: *Calia arizonica* (S. Watson) Yakovlev and *Calia secundiflora* (Ortega) Yakovlev (also in Mexico).

Perhaps unaware of the existence of *Calia*, Rafinesque (1838) published the generic name *Agastianis* Raf., but as this name is itself superfluous and an illegitimate substitute for the nomenclaturally rejected name *Broussonetia* Ortega (1798), its adoption is not possible without a formal act of conservation. Alternatively *Dermatophyllum* Scheele (1848), which has been recognized as a taxonomic synonym of *Calia* (Rudd 1972; Lewis & al. 2005), can be used. Accordingly, the following new combinations are required.

Dermatophyllum arizonicum (S. Watson) Vincent, comb. nov. *Sophora arizonica* S. Watson, Proc. Amer. Acad. 11: 135. 1876. *Calia arizonica* (S. Watson) Yakovlev, Trudy Leningradsk. Khim.-Farm. Inst. 21(4): 45. 1967 **TYPE: USA. Arizona**. Mojave Co.: Cactus Pass and on White Cliff Creek, 29 Jan 1854, *J.M. Bigelow s.n.* (holotype: GH! [photo DS!]; isotype: NY!).

Sophora formosa Kearney & Peebles, J. Wash. Acad. Sci. 29: 482. 1939. *Calia formosa* (Kearney & Peebles) Yakovlev, Trudy Leningradsk. Khim.-Farm. Inst. 21(4): 45. 1967. *Calia arizonica* subsp. *formosa* (Kearney & Peebles) Yakovlev, Trudy Leningradsk. Khim.-Farm. Inst. 26: 109. 1968. *Sophora arizonica* var. *formosa* (Kearney & Peebles) Tsoong, Acta Phytotax. Sin. 18: 73. 1980. **TYPE: USA. Arizona**. Graham Co.: below foot of Frye Mesa, Pinaleno Mts., 15 mi SW of Safford, 24 Apr 1935, *B. Maguire 10993* (holotype: US!; isotypes: ARIZ, GH, NY!, UC!, UTC [2 sheets]!).

Typification of *Sophora arizonica* S. Watson rests on a specimen at GH with label data stating that the specimen (a single stem, mounted on a sheet with *E. Palmer 65* and *J.M. Bigelow 33*) was collected at White Cliff Creek and Cactus Pass. Since the holotype specimen has both names on a single label and only a single stem, it is not possible to separate the locations, and the specimen at NY (which is labeled "White Cliff Creek" and "January 29") is best considered an isotype, following McManus (1976). Torrey (1857) originally identified this collection as *Sophora speciosa* (Scheele) Benth.

Dermatophyllum gypsophilum (B.L. Turner & A.M. Powell) Vincent, comb. nov. *Sophora gypsophila* B. L. Turner & A. M. Powell, Phytologia 22: 419. 1972. **TYPE: MÉXICO. Chihuahua**. Along Highway 16, 20 mi S of Coyame, 7 Apr 1971, *A.M. Powell et al. 2072* (holotype: TEX!; isotypes: MEXU, US!).

Dermatophyllum gypsophilum (B.L. Turner & A.M. Powell) Vincent subsp. **guadalupense** (B.L. Turner & A.M. Powell) Vincent, comb. nov. *Sophora gypsophila* B.L. Turner & A.M. Powell var. *guadalupensis* Turner & Powell, Phytologia 22: 421. 1972. **TYPE: USA. Texas**. Culberson Co.: Near Dog Canyon on the J.C. Hunter Ranch, NW slopes of Guadalupe Mts., 26 Sep 1955, *P. Uzzell s.n.* (holotype: SRSC!).

Dermatophyllum secudiflorum (Ortega) Gandhi & Reveal, comb. nov. *Broussonetia secondiflora* Ortega, Nov. Rar. Pl. Descr. Dec. 5: 61, t. 7. 1798. *Calia secundiflora* (Ortega) Yakovlev, Trudy Leningradsk. Khim.-Farm. Inst. 21(4): 45. 1967. *Cladrastis secundiflora* (Ortega) Raf.,

Neogenyton 1. 1825. *Sophora secundiflora* (Ortega) Lagerh. ex DC., Cat. Pl. Horti Monsp. 148. 1813. *Virgilia secundiflora* (Ortega) Cav., Icon. 5: 1. 1799. **TYPE: SPAIN.** Cultivated, Botanical Garden at Madrid "è seminibus missis per D. Sessé," *M. Lagasca s.n.* (lectotype: G-DC, **designated here**, based on annotations by R. McVaugh in herb. G-DC, fide Rudd 1968).

Calia erythrosperma Terán & Berland., Mem. Comis. Limites 13. 1832. **TYPE: USA. Texas.** Bexar Co.: "Habitat in Texas, prope S. Antonio de Béjar," *J.L. Berlandier s.n.* (lectotype: G, **designated here**.).

Dermatophyllum speciosum Scheele, Linnaea 21: 459. 1848. *Sophora speciosa* (Scheele) Benth., Boston J. Nat. Hist. 6: 178. 1850. **TYPE: USA. Texas.** Comal Co.: near New Braunfels ["Neubraunfels"], sin. dat., *F. Roemer s.n.* (lectotype: MO!, **designated here**; the original material seen by Scheele was destroyed during the Second World War).

Sophora secundiflora f. *xanthosperma* Rehder, J. Arnold Arbor. 10: 134. 1929. *Calia secundiflora* f. *xanthosperma* (Rehder) Yakovlev, Trudy Leningradsk. Khim.-Farm. Inst. 26: 107. 1968. **TYPE: USA. Texas.** Bexar Co.: San Antonio, Feb/Mar 1927, *L.W. Nuttall s.n.* (holotype: A!; isotypes: F!, PH!, UC!).

Calia secundiflora subsp. *albofoliolata* Yakovlev, Trudy Leningradsk. Khim.-Farm. Inst. 26: 107. 1968. **TYPE: MÉXICO. Coahuila.** La Esmeralda, 19 Nov 1925, *S. V. Juzepczuk 671* (holotype: LE; isotype: F!).

Dermatophyllum purpusii (Brandegee) Vincent, comb. nov. *Sophora purpusii* Brandegee, Zoë 5: 235. 1906. *Calia purpusii* (Brandegee) Yakovlev, Trudy Leningradsk. Khim.-Farm. Inst. 21(4): 45. 1967. **TYPE: MÉXICO. Coahuila.** Sierra de Parrás, Mar 1905, *C.A. Purpus 1076* (holotype: UC!; isotypes: F!, GH!, NY!, POM!, US!).

EXCLUDED SPECIES:

Sophora conzattii Standl., Contr. U.S. Natl. Herb. 23: 436. 1922. *Calia conzattii* (Standl.) Yakovlev, Trudy Leningradsk. Khim.-Farm. Inst. 21(4): 45. 1967. *Styphnolobium conzattii* (Standl.) M. Sousa & Rudd, Ann. Missouri Bot. Gard. 77: 575. 1990. **TYPE: MÉXICO. Oaxaca.** Cerro Espino near Pochutla, 24 Apr 1917, *C. Conzatti et al. 3171* (holotype: US! [photo CAS]).

Rudd (1972) speculated that *Sophora conzattii* was not best placed in the genus *Sophora*. The species was moved to *Calia* by Yakovlev (1967) but was later transferred to *Styphnolobium* (Sousa 1990; Sousa & Rudd 1993). Chromosome counts by Palamino et al. (1993) further support the placement of *St. conzattii* ($2n = 28$) in *Styphnolobium*, with *St. japonicum* ($2n = 28$), and differentiating it from *Dermatophyllum secundiflorum* ($2n = 18$).

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Kosovich-Anderson, Y.I. and W.A. Weber. 2011. Mosses of Wyoming's Beartooth Plateau: New noteworthy records for the Rocky Mountain region. Phytoneuron 2011-58: 1–10. Published 29 November 2011. ISSN 2153 733X

MOSSES OF WYOMING'S BEARTOOTH PLATEAU: NEW NOTEWORTHY RECORDS FOR THE ROCKY MOUNTAIN REGION

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ABSTRACT

Six moss species are reported for the first time from Wyoming: *Hygrohypnum styriacum, Imbribryum muehlenbeckii, Philonotis yezoana, Plagiobryum zierii, Santonia georgico-uncinata,* and *Thuidium recognitum.* The genera *Plagiobryum* and *Thuidium* are new to the state flora. Newly found taxa were documented at elevations of 2000–3260 meters in the Beartooth Plateau region. All of them are considered rarities in this portion of the Rocky Mountains. Remarkable is the discovery in the interior mountains of Wyoming of *Philonotis yezoana*, the globally rare East Asian and North American species of primarily oceanic temperate habitats — collections documented here were made 1100 kilometers from the nearest coast.

KEY WORDS: mosses, Wyoming, Beartooth Plateau, Rocky Mountains

This note is part of the first author's ongoing research on the bryoflora of Wyoming's Beartooth Plateau, located in the central Rocky Mountains of northwestern Wyoming (Fig. 1). Most of the Beartooth Plateau is located in Montana — the research is within the small southeastern corner of the Plateau, which stretches from Montana into Wyoming. This study is being conducted within the framework of bryophyte inventory projects on the Shoshone National Forest (SNF), begun in 2008. A physiogeographical description of the study area is given in previous articles (Kosovich-Anderson & Ignatov 2010; Kosovich-Anderson 2011). Six species are reported here that were not listed in Eckel's county checklist of Wyoming mosses (2007). All cited voucher specimens are housed in RM with duplicates in the author's personal herbarium; if they are elsewhere the herbaria are noted.

1. *HYGROHYPNUM STYRIACUM* (Limpricht) Brotherus (Amblystegiaceae). An arctic-alpine or montane species, typically occurring at alpine and subalpine elevations on wet rocks near flowing water, inundated or splashed, and in irrigated crevices of granite or slate rocks. It is known in Europe from the Alps and Tatras (Carpathian Mountains) and mountainous regions of Scandinavia, Britain, and Scotland (Nyholm 1965; Frey et al. 2006). A recent record from Spain marks the southern limit of its range in Europe (Rams & Olivan 2006). Outside of Europe it has been reported from Greenland and western North America; in the Rocky Mountains it occurs from British Columbia and Alberta to Montana, Idaho, and Utah, with the easternmost known station in Clear Creek County, Colorado, *Weber B-111133*, and extending westward to California (Goldberg 2003; Norris & Shevock 2004; Weber & Wittmann 2007; Jamieson 2011). *Hygrohypnum styriacum* is rare across most of its range. It is classified as "Imperiled" in British Columbia and "Critically Endangered" in Britain.

Figure 1. Wyoming's Beartooth Plateau, Rocky Mountains. Photo by R. Anderson.

Collection Data. Wyoming, Park Co., SNF, Beartooth Plateau. Beartooth Creek, granite debris along the creek, attached to boulders periodically wet by spray and seasonally covered with fast flowing water, assoc. with *Scouleria aquatica*, T57N R105W S7, 44° 56.270-280' N, 109° 36.010-020' W, elev. ca. 8,900 ft (2700 m), 23 Aug 2009, *Kosovich-Anderson 5431* (COLO). Beartooth Lake, W and SW shore, *Picea engelmannii* forest along the shore, on wet clay, assoc. *Saniona uncinata, Calliergonella cuspidata*, T57N R105W S6&7, 44° 56.500-520' N, 109°35.980-990' W, elev. ca. 8,900 ft (2700 m), 24 Jul 2010, *Kosovich-Anderson 6652*.

Both cited specimens have abruptly acuminate and reflexed leaf apices, typical for the species. In the newly prepared volume of Flora of North America (Jamieson 2011), the Wyoming occurrence of *Hygrohypnum styriacum* is based on *Kosovich-Anderson 5431*.

2. *IMBRIBRYUM MUEHLENBECKII* (Bruch & Schimper) Pedersen [*Bryum muehlenbeckii* Bruch & Schimper] **(Bryaceae).** A montane species, widely distributed but uncommon and generally rare in most parts of its range. Eurasia, Greenland, North America, and Atlantic Islands (Madeira). Southern Hemisphere collections are referred to other species. It occurs on acidic, very rarely calcareous, damp shaded rocks, soil in rock crevices, especially near streams and waterfalls, occasionally at mineral-rich springs, sometimes submerged in shallow water; elev. 500-3000 m (Frey et al. 2006; Spence 2010). The species is infrequent and scattered across North America from Newfoundland and Labrador to New England and Ontario, south to Michigan, New York, Pennsylvania, and Tennessee; from British Columbia to California and inland to Nevada, Utah, New Mexico, Idaho and Montana (Crum & Anderson 1981, Spence 2010).

Collection Data. Wyoming, Park Co., SNF, Beartooth Plateau: SE shore of Island Lake, ecotone zone between willow wetlands and subalpine *Picea engelmannii* forest, on wet loamy soil, in shade, T57N R105W S3, 44°56.690-700' N, 109°32.230-240' W, elev. ca. 9,500 ft (2900 m), 12 Aug 2008, *Kosovich-Anderson 2371* (ASC, COLO, DUKE) (det. by J. Spence).

The Park County collection is represented by small (up to 0.5 cm high) plants, dark green-red in color, with somewhat julaceous stems. According to Spence (2010), forms like these are morphologically close to small forms of the boreal-temperate *Imbribryum alpinum* (Hudson ex Withering) Pedersen but have strongly concave, ovate leaves, short distal laminal cells, and a weak costa. Both species are extremely variable, rarely form capsules, and difficult to identify.

Imbribryum muehlenbeckii is the second species of the genus documented for Wyoming after the recently reported *I. gemmiparum* (De Notaris) J.R. Spence [= *Bryum gemmiparum* De Notaris] (Spence 2010).

***3. PHILONOTIS YEZOANA* Bescherelle & Cardot in J. Cardot (Bartramiaceae).** Fig. 2. Globally rare species (conservation rank G2G3). *Philonotis yezoana* is an East Asian and North American species, originally described from Japanese and Korean specimens (Zales 1973). The species has a scattered distribution across the North American continent, mainly confined to the states and provinces of the Pacific and north Atlantic coast. The first record for Greenland was recently reported by Koponen (2009).

In the USA, *Philonotis yezoana* has isolated stations on the New England coast (Vermont, New York, and New Hampshire), scattered populations are also found along the Pacific coast (southeastern Alaska, Washington, and California), and several inland occurrences are known in northwestern Montana and central Idaho (Zales 1973; Crum & Anderson 1981; Griffin 2003; Kekes 2006; Duke Bryophyte Collection). Reportedly, *P. yezoana* is a species of primarily oceanic temperate habitats, but the species successfully survives under the conditions of hot and dry summer of interior California, where it occurs in mixed conifer forests of Sierra Nevada at the elevation 2000 m growing on seasonally dry rocks, receiving primarily winter snow as precipitation (Shevock, pers. comm.). In the mountains of Wyoming's Beartooth Plateau, *P. yezoana* was found growing in typical for the species situation – on wet granite rocks in the splash zone of the rapids of montane creek.

The Wyoming occurrence is unusual in being so far inland: it was registered 1100 km away from the nearest coast, in the interior mountains of the state, far east of the known disjunct sites in northwestern Montana and central Idaho. The eastern extension of plant species with Pacific coastal affinities is well known. The phenomenon, attributable to westerly winds that carry an oceanic climate influence well inland to the northern Rocky Mountains, has been observed in both vascular plants and bryophytes (Schofield 1965; Ahti & Fagersten 1967). It is reasonable to assume that these disjunct colonies of *P. yezoana* are the result of elimination of connecting habitats rather than relatively recent migrations.

Collection Data. Wyoming, Park Co., SNF, Beartooth Plateau: Lake Creek: rapids, overlook "Lake Creek Waterfall" 50 m N of HWY 212, sheltered granite outcrops lining the waterfall, under the steep bank forested by *Pseudotsuga menziesii, Pinus contorta*, and *Picea* sp. on thin wet soil covering an outcrop's surface, shaded by spruce, in splash zone of the waterfall, assoc.: *Blindia acuta* and leafy liverworts, T57N R107W S8, 44°55.485-490' N, 109°41.670-675' W, elev. ca. 7,500 ft (2280 m), 26 Aug 2009, *Kosovich-Anderson 5850* (COLO, DUKE); steep rocky bank forested with *Picea* sp., over rock on a patch of soil, in splash zone of creek, forms scarce admixture to *Scapania* sp., T57N R107W S17, 44°55.350-355' N, 109°42.430-435' W, elev. ca. 6,900 ft (2100 m), 5 Aug 2010, *Kosovich-Anderson 8397*.

Figure 2. *Philonotis yezoana*, habit. Photo by Y. Kosovich-Anderson.

Both documented populations of *Philonotis yezoana* have signs of low vitality: scant and sterile plants in poor mats, intermingled with other bryophytes. However, the Wyoming plants of *P. yezoana* are distinctive in morphology — the irregularly subquadrate and rectangular leaf cells with single massive central papillae on both surfaces, along with the dark green color, make the species easy to recognize.

4. *PLAGIOBRYUM ZIERII* (Hedwig) Lindberg (Bryaceae). Fig. 3. A species and genus new to Wyoming. *Plagiobryum zierii* is a rare arctic-alpine species with a disjunct circumboreal distribution in Eurasia, Africa, North America, and Central America (Guatemala), typically growing on wet dripping rocks and in crevices of cliffs (most frequently basic), often in the spray zone of waterfalls and also in tundra communities and on soil faces of frost boils and other erosional features of wet tundra. In North America, the species is represented by scattered populations from Greenland to Quebec, Newfoundland, and Labrador, south to Vermont and disjunct to Manitoba; from Alaska, Yukon, and Northwest Territories south through the Rocky Mountains to Oregon and inland to Idaho, Montana and Colorado (Ireland 1982; Hedderson 2007).

Figure 3. *Plagiobryum zierii*, habit. Photo by Y. Kosovich-Anderson.

In Wyoming's neighboring states, *Plagiobryum zierii* is a rarely collected species. A few populations are known in Colorado, where it was found in four counties growing on subalpine seeping cliffs and in moist tundra (Weber & Wittmann 2007). Reports from Montana are based only on the collection of Williams, made at the end of 19th century, at Great Falls in Glacier National Park (Elliott 1993). On the Beartooth Plateau, the species was discovered in two places at a distance of 10 kilometers from each other — on Clarks Fork of Yellowstone River and Crazy Creek, on rocks in the spray zone.

As Spence believes (pers. comm.), the species is probably relictual in the Rocky Mountains south of the glacial maximum and presumably reached its current distribution during the Pleistocene. Populations south of the glacial ice sheets in the Rockies survived in refugia such as Colorado and expanded north during the Holocene.

Collection Data. Wyoming, Park Co., SNF, foothills of the Beartooth Plateau: Clarks Fork of Yellowstone River, immediately SE of junction of Muddy Creek and Clarks Fork of Yellowstone River, gravel shore of Clarks Fork, massive granite boulders along the shore in seasonal splash zone, on wet clayey substrate in a rock crevice, not abundant, T57N R107W S28, 44°53.965-970'N, 109°40.310-315'W, elev. ca. 6,600 ft (2000 m), 26 Aug 2009, *Kosovich-Anderson 5951* (ASC, COLO) (Det. by J. Spence); approx. 0.05 mi N-NE of Clarks Fork of Yellowstone River and Crazy Creek confluence, cataracts of Crazy Creek, seeping granite cliff, on a soaked humus soil, in shade, scattered among other bryophytes: *Cephaloziella* sp. and *Mnium* sp. T57N R107W S3&10, 44°56.600-620'N, 109°46.555-565'W, elev. ca. 6,900 ft (2100 m), 3 Aug 2010, *Kosovich-Anderson 7972*.

The collections from Wyoming represent plants typical of this taxon, with julaceous, white and silvery green shoots reddish below and broadly ovate, flat-margined leaves. Both specimens are sterile.

The genus *Plagiobryum* Lindberg is new for the Wyoming flora. It is predominantly an alpine genus, easily recognized when fruiting by the large, gibbous and zygomorphic capsules although gametophytically not well-separated from *Bryum* sensu lato. Important generic features are the following (on Shaw 1982, with additions by Spence): stems simple or forking when sterile, innovating abundantly when bearing gametangia; leaves of innovations smaller than those of main stems; costa rather narrow, ending below the apex to excurrent; cells thin-walled, laxly hexagonal or rhomboidal, very long; dioicous; seta rather short and stout, geniculate; capsules horizontal to nodding, zygomorphic; exostome teeth narrowly lanceolate, shorter than the endostome segments, rather abruptly narrowed from an orange base; strongly bordered, trabeculate segments of endostome narrow but keeled, narrowly perforate; spores coarsely papillose to reticulate or warty, often remaining in tetrads at capsule maturity.

5. *SANIONIA GEORGICO-UNCINATA* (Müller Halle) R. Ochyra & L. Hedenäs [*S. nivalis* Hedenäs] (Amblystegiaceae). A species with bipolar range, mostly distributed in arctic regions of the Northern Hemisphere extending southward to mountainous regions of cool temperate latitudes and after extensive disjunction reappearing in the polar zone of the Southern Hemisphere. It typically grows in large late snowbeds and on the shores of glacier-fed brooks. The general distribution of *Sanionia georgico-uncinata* includes Greenland, North America (Northwest Territories, Yukon, Alaska, Montana), northern Eurasia, and Antarctic (Hedenäs 2000; Ignatov et al. 2006; Ochyra et al. 2008). In North America, populations are mostly confined to the arctic and northern portions of the Rocky Mountains, becoming rare southward. The species is known in Montana only from two collections made by J. M. Holzinger in 1898 on Sperry Glacier (S, NY), in the northwestern part of the state (Hedenäs, pers. comm.).

During the summer expedition of 2008 (and later in 2009), the first author collected *Sanionia georgico-uncinata* from several populations in the Beartooth Plateau. These occurrences are a southeastward range extension of over 500 km from the nearest known populations in Montana. Almost simultaneously, in September of 2008, the species was collected in Colorado, growing in melt-water brooklets at Summit Lake on Mt. Evans (*L. Hedenäs* reg. no *B141515*, S; Hedenäs, pers. comm.). The Colorado discovery extended the range of the species 650 km further southeastward. Thus, this location is over 1150 kilometers southeast of those of previously reported specimens in

Montana and represents a significant extension of the known range of this moss in North America. All newly documented stations are confined strictly to upper subalpine and alpine elevations (2950–3260 m in Wyoming, 3900 m in Colorado), further documenting a highly disjunct arctic-alpine distribution.

Santonia georgico-uncinata is separated from the other North American *Santonia* species by the following key characters: its reduced and irregularly perforate endostome, acute to rather suddenly acuminate inner perichaetial leaves with strongly denticulate or dentate upper margins, relatively shortly acuminate stem leaves with strongly denticulate margins and by the structure of the alar and supra-alar cells (Hedenäs 2000; Ochyra et al. 2008).

Identification of *Santonia georgico-uncinata* is problematic without sporogones; unfortunately, plants with capsules are rare. Reported below are only fertile specimens with mature sporogones.

Collection Data. Wyoming, Park Co., SNF, Beartooth Plateau: alpine *Caltha leptosepala* + *Sedum* sp. + *Carex* spp. – Bryidae fen in small depression beside the head of National Forest Trail # 623, 100-150 m E of Beartooth Scenic Byway, on wet peaty soil, locally abundant, forms pure mats and assoc. with *Plagiomnium ellipticum, Polytrichum juniperinum, Sarmentypnum exannulatum, S. sarmentosum*, S+, T58N R104W S28, 44°58.770-775' N, 109°25.530-540' W, elev. ca. 10,700 ft (3260 m), 19 Aug 2008, *Kosovich-Anderson 3430* (COLO, MO, S); unnamed tributary of Frozen Lake, seepage slope, on soaked peaty soil and wet clay along streamlets, snow melt area, in pure mats and assoc.: *Polytrichastrum sexangulare*, *Polytrichum juniperinum*, and *Brachythecnum brandegei* (the latter is a rare alpine species, endemic of Colorado and Wyoming (Kosovich-Anderson & Ignatov 2010)), S+, T58N R104-105W S31&36, 44°58.050-060' N, 109°28.870-890' W, elev. ca. 10,500 ft (3200 m), 14 Aug 2008, *Kosovich-Anderson 2626A*; head of an unnamed tributary to Littlerock Creek, 0.8 km E of Christmas Lake, a basin toe slope alpine fen "Littlerock Creek Fen", *Salix planifolia* – Bryidae hummocks, on wet peaty soil, in pure mats, S+, T58N R104W S34, 44°58.050-055' N, 109°24.840-850' W, elev. ca. 10,650 ft (3250 m), 21 Aug 2008, *Kosovich-Anderson 3558*; broad subalpine valley overlying Quaternary glacial deposits, approx. 1 mi E-SE of Sawtooth Lake, Sawtooth Palsa Fen with raised peat overlying permafrost, *Salix* sp. - *Sphagnum warnstorfii*, on wet peaty soil, S+, T57N R104W S29, 44°53.670-675' N, 109°27.540-550'W, elev. ca. 9680 ft (2950 m), 25 Aug 2009, *Kosovich-Anderson 5752*. *Wyoming's Sawtooth Palsa Fen is the only known occurrence of a palsa-type fen in the lower 48 states (Heidel et al. 2008).

6. *THUIDIUM RECOGNITUM* (Hedwig) Lindberg (Thuidiaceae). Fig. 4. A species and genus new to Wyoming. *Thuidium recognitum* is a large and beautifully pinnately branched moss widely distributed in the circumboreal zone of Eurasia and North America, where it occurs in woodlands and wet meadows, on shady soil and humus, infrequently on rotting wood and rocks, on sheltered banks, often indicating rich habitats and usually confined to calcareous regions (Lawton 1971; Ignatov & Ignatova 2004; Frey et al. 2006). "*Thuidium* is common and species diverse in the eastern United States as well as in most of the Northern Hemisphere. Its absence from western North America is nearly complete except for an arc of distribution that extends from eastern North America into the high Arctic thence southward in the mountains of Alaska and British Columbia barely reaching Washington State." (Norris & Shevock 2004, p. 248–249). *T. recognitum* also is known from Oregon, Idaho, Montana, and South Dakota (Lawton 1971; Crum & Anderson 1981; Elliott 1993).

Thuidium recognitum is infrequent or even rare in Wyoming, where it occurs close to its distributional limit in this portion of its range. On the Beartooth Plateau, it was discovered in wet spruce forest, in sheltered lowland at montane lake, where it grows in pure "carpets" and mixed-

species mats. The community is generally characterized by high bryophyte diversity and abundance, creating for Wyoming an unusual picture of a northern boreal forest with bryophyte coverage up to 100%, dominated by typical luxuriant form of *Hylocomium splendens* combined with *Aulacomnium palustre*, *Climacium dendroides*, *Helodium blandowii*, *Rhizomnium* spp., *Thuidium recognitum*, *Marchantia alpestris*, and others.

Collection Data. Wyoming, Park Co., SNF, Beartooth Plateau: Lily Lake shore, wet spruce forest, *Picea* sp. – *Alnus incana* – *Linnaea borealis* + *Equisetum variegatum* - Bryidae, under recently fallen spruce, on wet litter and humus, locally abundant, T57N R107W S6, 44° 56.880-890' N, 109° 42.930-940' W, elev. ca. 7,700 ft (2350 m), 17 Aug 2008, *Kosovich-Anderson 3047* (COLO, MO).

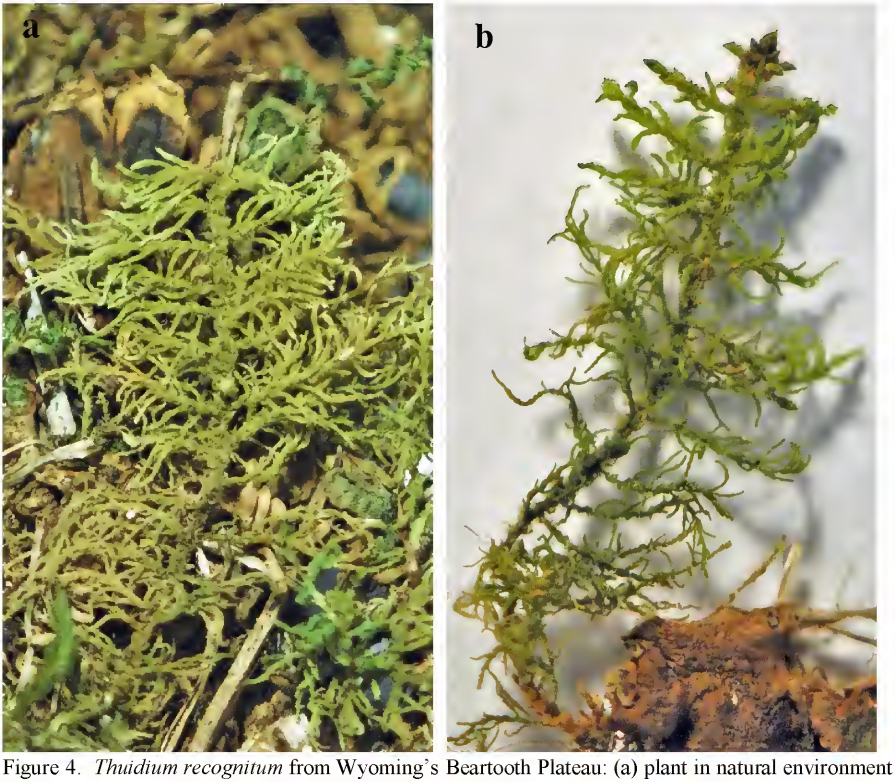

Figure 4. *Thuidium recognitum* from Wyoming's Beartooth Plateau: (a) plant in natural environment and (b) herbarium specimen. Photos by Y. Kosovich-Anderson.

The genus *Thuidium* Bruch & Schimper is new to Wyoming. The most striking distinction separating *Thuidium* from closely related *Abietinella* Müller Halle is its branching pattern — the shoots of *Thuidium* are twice/several times pinnately branched vs. 1-pinnately branched in *Abietinella* (the generic name "*Thuidium*" alludes to branched habit of *Thuja*). Also, *Thuidium* has 2–3-pinnate branching paraphyllia and leaf cells 1-papillose abaxially whereas *Abietinella* has paraphyllia simple

or not strongly branching and cells 1-papillose on both leaf surfaces; there also are distinctions in the structure and color of axillary hairs (Buck & Crum 2010).

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CONTRIBUTIONS TOWARD A REVISION OF *HECHTIA* (BROMELIACEAE, PITCAIRNIOIDEAE). I. NEW AND NOTEWORTHY SPECIES OF *HECHTIA* FROM MEXICO

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ABSTRACT

Hechtia hintoniana Burt-Utley, Utley, & García-Mendoza, **Hechtia michoacana** Burt-Utley, Utley, & García-Mendoza, **Hechtia oaxacana** Burt-Utley, Utley, & García-Mendoza, and **Hechtia pueblensis** Burt-Utley, Utley, & García-Mendoza are described as new, illustrated, and discussed, while *H. sphaeroblasta* B.L. Robinson is reinterpreted. The taxonomic status of three species, *H. bracteata* Mez (syn. *H. confusa* L.B. Smith), *H. texensis* L.B. Smith (syns. *H. elliptica* L.B. Smith and *H. zacatacae* L.B. Smith), and *H. glomerata* (syn. *H. mexicana* L.B. Smith), are evaluated. *Hechtia tehuacana* B.L. Robinson is lectotypified and its continued status as a heterotypic synonym of *H. podantha* Mez is discussed.

KEY WORDS: Bromeliaceae, *Hechtia*, México, Michoacán, Oaxaca, Puebla.

Hechtia Klotzsch (Bromeliaceae) is a genus of approximately 55 species that occurs primarily in seasonally dry karstic regions in Mexico. Within Mexico, the genus is best represented in Oaxaca and adjacent Puebla where 19 species have been reported, including the two described herein (pers. obs.; Smith & Downs 1974). Most of these species have very limited distributions that may result from geographic barriers to dispersal as well as from requirements for unique combinations of climatological and edaphic factors. Of the new taxa described here, *H. oaxacana* is known from several areas in northern Oaxaca, where individuals can be found on steep, exposed rocky cliffs and karstic hillsides. *Hechtia hintoniana* and *H. michoacana* occur in Michoacán and, considering their distributions, are expected within the range of Flora Novo-Galiciana. With the additions of these latter two species, there are now 12 *Hechtia* species recognized within all of Michoacán, Colima, and Jalisco. *Hechtia pueblensis* includes the pistillate material present on the type series of *H. tehuacana*. Because characterization of *H. tehuacana* was based primarily on leaves and staminate material, *H. tehuacana* is still considered a synonym of *H. podantha*. *Hechtia bracteata* is re-evaluated based on collections from Veracruz and Puebla, while further collections from northern Mexico support the synonymy of *H. elliptica* and *H. zacatacae* with *H. texensis* S. Watson. The synonymy of *H. mexicana* L.B. Smith with *H. glomerata* Zuccharini is discussed.

1. **HECHTIA HINTONIANA** Burt-Utley, Utley, & García-Mendoza, sp. nov. **TYPE. MEXICO. México.** Ladera con Guerrero, San Antonio, Tlatlaya, 750 m, 20 Jul 1954, *E. Matuda et al. 31124* (holotype: MEXU; isotypes: CAS, MEXU, MO, NY, US). Figure 1.

Planta florens ad 20 dm alta; laminae spinosae ubique lepidotae. Inflorescentia probiliter terminalis; inflorescentia masculorum tripinnata sed femineorum bipinnata vel tripinnata lanata; masculorum rami laterales cum ramis secundaris (2—)3—6; rami laterales (4.5—)7.8—22 cm longi; ♀ rami laterales (6.5—)15—31 cm longi. Florum masculorum subsessilibus lepidotis; sepala ovato-triangularia vel oblonga, 0.7—1.3 mm longa lepidota. Florum femineorum pedicellis 0.8—1.5 mm longis lepidotis; sepala triangulares vel ovato-triangulares 1.7—2.1 mm longa lepidota. Capsulae ovoideae 8—10 mm longae.

Plants in flower with inflorescences to 20 dm high. **Leaves** presumably numerous; sheaths narrow, 3.5—5.5+ cm wide, marginally spinose and floccose, distally lepidote above and beneath; blades straight to somewhat falcate, very narrowly triangular to almost linear, 36.5—93+ cm long and 0.6—2.2(—3.5) cm wide above the sheath, lepidote above and beneath, the margins armed with generally antrorse red-brown to pale yellow tips 0.7—1.5 cm apart and 1.8—2.5 mm long. **Inflorescences** presumably terminal, in staminate individuals lepidote and twice compound with (2—)3—6 secondary branches; in pistillate individuals lepidote and once, or if twice compound then with 1—2 short secondary branches, scape to 88+ cm long, 1.2—1.4 cm diam, glabrous to glabrescent; lowermost scape bracts unknown, upper scape bracts chartaceous, ascending, shorter than the internodes, rarely equal to or exceeding the internodes, lance-ovate with adpressed linear-triangular blades 1.5—3.9 cm long; rachis to 10.2+ dm long, irregularly to finely lepidote; primary bracts chartaceous, generally shorter than all but the shortest lateral branches, ovate with short linear-triangular blades, 1.4—3(—4.4) cm long, marginally finely spinulose; lateral branches not articulated with the rachis, flattened throughout or rounded and sulcate distally, ascending to subascending, the staminate (4.5—)7.8—22 cm long, the pistillate (6.5—)15—31 cm long, densely many-flowered throughout or flowers in verticils, lepidote. **Staminate flowers** spreading to weakly ascending; floral bracts shorter than to exceeding the pedicels, chartaceous, ovate-triangular to oblong or suborbicular, flat to weakly convex, 0.7—1.5 x 0.4—1 mm, externally lepidote, marginally finely serrulate to erose, apically variable, spinulose or apiculate to praemorse; pedicels weakly articulated with the axis, stout, subsessile, lepidote; sepals somewhat imbricate, subequal, ovate-triangular to oblong, convex, 0.7—1.3 X 0.7—1.3 mm, marginally entire to erose distally, apically praemorse, lepidote to glabrous; petals spreading at anthesis, oblong-elliptic to ovate-elliptic becoming spathulate when dry, 2—3 X 1.4—2 mm, marginally entire, apically denticulate to praemorse, glabrous; stamens 6, filaments basally briefly adnate to the petals; ovary rudimentary. **Pistillate flowers** spreading to ascending; floral bracts shorter than to exceeding the pedicels, chartaceous, narrowly ovate-triangular, flat to weakly convex, 1.3—2.2 X 0.8—1.5 mm, marginally entire to serrulate or erose, apically attenuate-acuminate to praemorse, lepidote; pedicels articulated with the rachis, stout, 0.8—1.5 mm long, lepidote; sepals marginally hyaline, subimbricate, triangular to ovate-triangular, 1.7—2.1 X 1—1.8 mm, marginally entire, apically rounded to acute or praemorse, glabrous to weakly lepidote; petals spreading post-anthesis, narrowly ovate-triangular, 3.1—4 X 1.2—1.9 mm, apically rounded, glabrous; stamens rudimentary; ovary largely superior, glabrous. **Capsules** with stout pedicels 0.8—1.5 mm long; woody, loculicidally and septicidally dehiscent, ovoid, 8—10 X 3—4.5(—5.5) mm, glabrous, shiny and somewhat ridged-reticulate.

Etymology. This species is named in honor of George B. Hinton (1882–1943), who first collected this species in 1934 and made many important plant collections in then remote regions in the states of México, Guerrero, and Michoacán. Hinton noted on the herbarium label of *Hinton et al. 8098* that the plant was dead and maguey-like, an observation that is not surprising since individuals of a number of *Hechtia* species give the appearance of being dead because of their leaf coloration, coupled with their pubescence, and they have the general habit of some *Agave* species.

Distribution and habitat. *Hechtia hintoniana* is known only from the states of México and Michoacán, but it is likely to occur in Guerrero. It occurs in deciduous forests, as well as in barrancas, dry roadsides, and thickets between 750 and 900 m elevation.

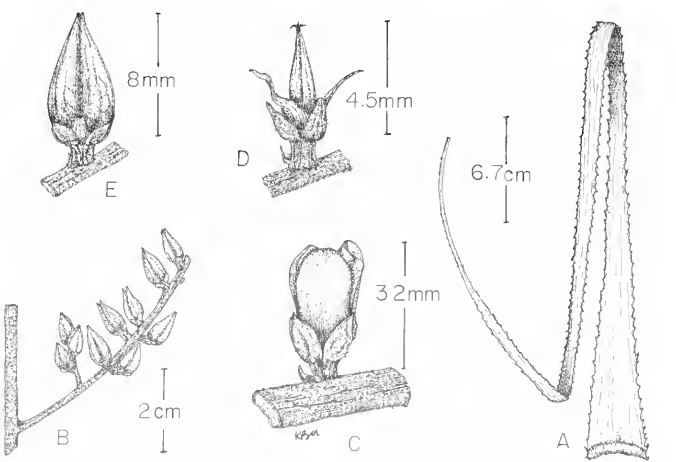

Figure 1. *Hechtia hintoniana*. A. Leaf. B. Part of lateral branch of pistillate inflorescence. C. Staminate flower just prior to anthesis, side view. D. Pistillate flower. E. Capsule. (A, B, D and E from *Moore et al. 5722*, US; C from *Matuda 31124*, NY).

Hechtia hintoniana immediately stands apart from almost all other *Hechtia* species in its extremely narrow, very long linear-triangular leaf blades, as exemplified by *Hinton 6506* where the blade is in excess of 93 cm long, but only 1.9 cm wide above the leaf sheath. Unlike both *H. michoacana* and *H. reflexa* L.B. Smith with glabrous lateral branches, floral bracts, and pedicels, those of *H. hintoniana* are consistently conspicuously lepidote. *Hechtia hintoniana* also differs from these species in its subsessile staminate pedicels and shorter pistillate pedicels. In its pubescence *H. hintoniana* is similar to *H. laevis* L.B. Smith but is immediately distinguishable from this latter taxon by its twice-compound inflorescences, branches that generally are flattened for most if not all their

length, subsessile staminate flowers, and very short pedicellate pistillate flowers. *Hechtia hintoniana* shares its reticulate-ridged capsules with *H. reticulata* L.B. Smith but can be separated from this taxon by its twice compound pistillate inflorescences, pubescence, and shorter pistillate pedicels (0.8—1.5 mm vs 2.5—3.5 mm). See Table 1.

Additional specimens examined. MEXICO. México. Dto. Temascaltepec, Naranjo, 27 Aug, 1934, *G.B. Hinton 6506* (K, US); Bejucos, 26 Jul 1935, *Hinton 8098* (K, US). **Michoacán.** ca 44.5 km from El Temascal on rd to Huetamo, 900 m, 13 Nov 1949, *H. Moore et al. 5722* (BH, BM, US [2]).

	H. hintoniana	*H. laevis*	*H. michoacana*	*H. reflexa*
Blade length (cm)	36.5+—93+	29—60	26—61	40—116+
Blade width (cm)	0.6—2.2(—3.5)	2.3—3.7	1.2—2.4(—2.9)	2.8—4
Lowermost scape bract orientation	unknown	reflexed above sheath	ascending	reflexed above sheath
♀ inflorescence	twice compound	once compound	once compound, rarely twice compound	twice compound
♂ pedicel length (mm)	subsessile <0.5	(1—)1.6—4	(0.8—)1.3—2.2	(1—)1.3—1.8)
♂ petal length (mm)	2—3	1.9—2.9	(1.6—)3—3.5	2.1—2.7
♀ pedicel length (mm)	0.8—1.5	1.5—3.5	1.5—3.5(—4.5)	(1.5—)3—4.2
♀petal length (mm)	3.4—4	2.5—4	(2.3—)3—4.5	4—5

Table 1. Comparison of *H. hintoniana*, *H. laevis*, *H. michoacana*, and *H. reflexa*

2. HECHTIA MICHOACANA Burt-Utley, Utley, and García-Mendoza, sp. nov. **TYPE. MEXICO. Michoacán.** 13.9 mi SE of S side of Puente Coahuayana at Colima-Michoacán border, 300—400 ft, 11 Aug 1989, *J. Utley & K. Utley 8456* (holotype: MEXU; isotypes: CAS, GH, IBUG, M, MICH, MO, NY, US, USF). Figure 2.

Planta florens 0.3—0.9 m diam et (5.5—)10.2—14 dm alta; folia 26—61 cm longa; lamina ubique lepidota. Inflorescentia terminalis; rami laterales 6—22.5 cm longi; inflorescentia masculorum tripinnata plerumque cum ramis secundaris 0—2 sed femineorum bipinnate raro tripinnate. Florum femineorum petala triangularia vel ovato-triangularia (2.3—)3—4.5 longa et 1—1.2 mm lata patentia. Capsulae crustaceae (5—)6—9 mm longae, 2.5—4.5 mm diam.

Plants in flower 0.3—0.9 m diam and inflorescences (5.5—)10.2—14 dm high, usually occurring in clusters of individuals. **Leaves** several, subascending to spreading, recurving distally, 26—61 cm long; sheaths on oldest leaves reniform to transversely elliptic, 2.5—4.5 X (3.5—)4.4—5.7(—8.5) cm, marginally spinose and floccose, both surfaces glabrous and lustrous becoming lepidote distally; blades straight to falcate, very narrowly triangular, 1.2—2.4(—2.9) cm wide just above the sheath, often very densely lepidote above and lepidote below, green to maroon, the margins armed with generally antrorse or occasionally spreading or retrorse red-brown tips 0.7—2.5 cm apart and tips (2—)2.5—4.5(—5) mm long. **Inflorescences** terminal, in staminate individuals usually twice compound with 1—2 secondary branches, or rarely once compound, glabrous; in pistillate individuals once compound or rarely with 1—2 short secondary branches, glabrous; scape 35—99.5 cm long, 3.5—7 mm diam, glabrous; lowermost scape bracts foliaceous, ascending, greatly exceeding the internodes, 19—26 cm long, lepidote; the remaining scape bracts becoming progressively reduced distally and shorter than to exceeding the internodes, ovate-triangular with linear blades, 1.1—8 cm long; rachis 35—92 cm long; primary bracts chartaceous, 0.9—2.7 cm long, much shorter than the lateral branches and usually shorter than the sterile bases of branches; lateral branches laxly many-flowered, proximally flattened, those of staminate inflorescences ascending to subascending, but those of pistillate inflorescences arcuate and ascending to subascending, 6.5—22.5 cm long. **Staminate flowers** spreading to subascending, floral bracts adnate to the pedicels and often exceeding the pedicels but shorter than the sepals, membranaceous, convex, ovate 1.2—2.5 X 0.7—1.2 mm, marginally finely serrulate distally, apically apiculate to attenuate-acuminate, glabrous; pedicels slender, (0.8—)1.3—2.2 mm long; sepals membranaceous, ovate, 0.9—1.5 X 0.5—1.1 mm, marginally entire to serrulate distally, apically incised to praemorse or apiculate, deep to light pink or green with maroon maculations; petals elliptic but drying spathulate, (1.6—)3—3.5 X 1—1.7 mm, apically rounded, white, cream-colored or light to dark pink; stamens 6; ovaries rudimentary. **Pistillate flowers** ascending to subascending; floral bracts adnate to the pedicels, shorter than the sepals, chartaceous to membranaceous, narrowly ovate to ovate, convex, 1.5—2.5 X 0.8—1.8 mm, marginally entire to finely erose, apically variable, apiculate to attenuate-acuminate or praemorse, glabrous; pedicels slender, not articulated with the rachis, slender, 1.5—3.5(—4.5) mm long, glabrous; sepals membranaceous, triangular to ovate-triangular, 1.2—2 X 0.7—1.1 mm, marginally entire to serrulate distally, apically acute-praemorse to apiculate, glabrous, colored like the staminate sepals; petals spreading, narrowly triangular, (2.3—)3—4.5 X 1—1.2 mm, apically rounded, glabrous, colored like the staminate petals; stamens rudimentary; ovary largely superior. **Capsules** with pedicels (1.5—)2.5—5 mm long, crustaceous, loculicidally and septicidally dehiscent, narrowly ovoid to narrowly ellipsoidal, (5—)6—9 X 2.5—4.5 mm, glabrous, smooth, green suffused with red when immature but becoming yellow-brown and reticulate at maturity.

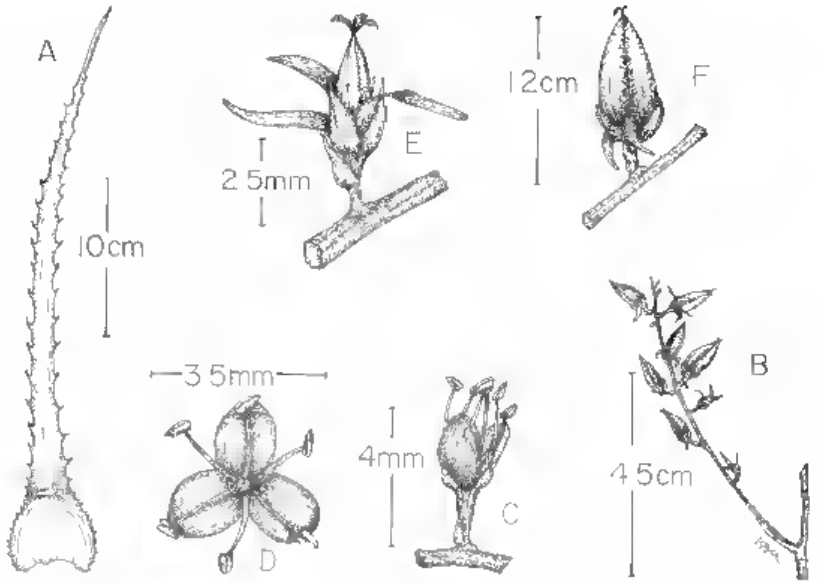

Figure 2 *Hechtia michoacana* A Leaf B Part of lateral branch of pistillate inflorescence C Staminate flower just opening, side view D Staminate flower, face view E Pistillate flower post-anthesis F Capsule (A B D E and F from *Utley & Utley 8456* C and D from *Utley & Utley 8386*)

Distribution and Habitat. *Hechtia michoacana* is found between 300–1400 ft elevation, growing on karstic rocks or rocky hillsides in full sunlight with thorn-scrub vegetation or adjacent to tropical deciduous forests with *Bursera Plumeria* and *Cnidoscolus*

Pedicel length is variable among pistillate specimens of *Utley & Utley 8456* and *Utley & Utley 8386* but are generally longer than those of staminate flowers In addition to this dimorphism, inflorescences of staminate inflorescences are typically twice compound, while those of pistillate inflorescences are once compound Dimorphisms for floral or inflorescence were observed in *H glauca* Burt-Utley & Utley (Burt-Utley & Utley 1993) as well as in *H matudae* L B Smith and other species pers obs) Unlike the conspicuously lepidote leaves of individuals from the coast of Michoacan, those from near Infernillo (*Utley & Utley 8386*) appear lustrous and glabrous but close examination revealed abundant trichomes with diaphanous wings thus giving the leaves their glabrous appearance This level of variability is not unusual and has been observed within populations of other *Hechtia* species (pers obs) Flower color among individuals of the same sex varied from population

to population, ranging from white to cream or dark pink. This variability can be observed in other *Hechtia* species, including *H. lyman-smithii* Burt-Utley & Utley. In Michoacán and elsewhere in western Mexico, *H. michoacana* is most similar to *H. reflexa* L.B. Smith, which has reflexed lateral branches. This character can be observed on mature pistillate inflorescences of *H. reflexa* and contrasts with the subascending to ascending branches of pistillate and staminate inflorescences of *H. michoacana*. *Hechtia michoacana* also differs from *H. reflexa* in its less numerous secondary branches on staminate inflorescences (0–2 vs 3–7) and larger staminate petals [(1.6–)3–3.5 X 1–1.7 mm vs 2.1–2.5 X 1.2–1.5 mm]. *Hechtia michoacana* is similar to *H. laevis* in its pistillate and staminate flower form but lacks the conspicuously lepidote inflorescences, floral bracts, pedicels, and sepals characteristic of this latter taxon. See Table 1.

Additional specimens examined. **MEXICO. Michoacán.** 4 km carratera Placita-Tecoman, Mpio. Aquila, 250 m, 9 Dec 1979, *P. Guerrero C. et al. 555* (USF, XAL); 300 m, 5 Nov 1990, *Guerrero C. et al. 1315* (USF, XAL); 4.6 mi SE of Hwy 37 on rd to Infernillo, 1000 ft, 21 Dec 1988, (fr) *Utley & Utley 8267* (MEXU, USF); 9.5 mi SE of Hwy 37 on rd to Infernillo, 1400 ft, 10 Jul 1989, *Utley & Utley 8386* (B, M, MEXU, MICH, US, USF).

3. **HECHTIA OAXACANA** Burt-Utley, Utley, and García-Mendoza, sp. nov. **TYPE. MEXICO. Oaxaca.** North-central Oaxaca growing on steep hillsides and karstic rock outcrops with secondary vegetation, 5500–5700 ft, 28 Jul 1987, *J. Utley & K. Utley 7960* (holotype: MEXU; isotypes: CAS, GH, M, NY, US, USF). Figure 3.

Planta florens ad 0.5 m diam et (7.2—)11.6—17.7(—19.5) dm alta; folia multa; lamina ubique lepidota. Inflorescentia terminalis. Florum masculorum pedicelli (0.5—)1.5—2(—3) mm longi; bracteae florales lepidotae vel glabrae pedicellum excedentes et sepala interdum excedentia; sepala ovata vel ovato-triangularia 1.2—2.5(—3.5) mm longa et 1.3—2.5 mm lata. Florum femineorum pedicelli 1—2 mm longa; bracteae florales sepala interdum excedentia anguste ad late ovatas vel ovato-oblongas 3—6 mm longa et 3—5.5 mm lata; petala 3—4.5(—5.5) mm longa. Capsulae ovoideae 7—9(—11.5) mm longae et (3—) 4—5(—6) mm diam.

Plants in flower with rosettes 0.3—0.5 m diam and inflorescences (7.2—)11.6—17.7(—19.5+) dm high, usually in large colonies to 3—5 m diam. **Rosettes** occasionally producing stout stolons. *Leaves* very numerous, subascending but becoming subspreading with age (13—)22—45.5 cm long; sheaths on older leaves reniform to transversely elliptic, 2.3—5.6 X (3.5—)5—8.3 cm, lepidote distally above and beneath, marginally spinose and floccose; blades straight to falcate, narrowly triangular, (1—)1.5—2(—2.5) cm wide above the sheath, lepidote to glabrescent above and lepidote below, the margins armed with generally antrorse or occasionally retrorse red-brown tips (0.4—)1.4—2(—2.5) cm apart and (1.5—)2.5—3.5(—4.5) mm long. **Inflorescences** terminal, in both staminate and pistillate individuals glabrous to lepidote and once compound, or rarely twice compound with very short basal secondary branches in staminate inflorescences; scape 43—71.5 cm long, (6—)8—14(—18) mm diam, glabrous to finely lepidote; lowermost scape bracts numerous, foliaceous, ascending, (13—)16—22 cm long with narrowly linear-triangular spinose blades; upper scape bracts ascending, generally exceeding the internodes, rarely equal to or shorter than the internodes, lance-ovate with adpressed linear-triangular blades (2.2—)3.4—5.9 cm long; rachis often weakly geniculate, (3.3—)5.5—7.8(—13.9) dm long, irregularly to finely lepidote or glabrous; primary bracts generally shorter than all but the shortest lateral branches, (0.7—)1.5—2.5(—3.8) cm long, marginally finely spinulose, glabrous to lepidote; lateral branches articulated with the rachis, flattened basally, sulcate when dry, ascending to subascending, (1—)2—11(—17.5) cm long, laxly to very densely many-

flowered throughout and then appearing substrobiliform to strobiliform, glabrous to lepidote **Staminate flowers** spreading to subascending or ascending, floral bracts shorter than to equaling or exceeding the sepals, rugulose proximally cartilaginous to chartaceous, narrowly to broadly ovate or ovate-triangular to suborbicular, flat to convex, (2 2—)3—7(—9) X (1 7—)2 5—5(—6) mm, externally glabrous to finely lepidote, marginally finely spinulose to erose, apically variable, spinulose to apiculate, acute, rounded or praemorse, pedicels articulated with the rachis, stout, (0 5—)1 5—2(—3) mm long, glabrous to lepidote, sepals somewhat imbricate, subequal, ovate to ovate-triangular, convex, 1 2—2 5(—3 5) X 1 3—2 5 mm, marginally entire to erose, apically rounded to acute or praemorse, glabrous, petals spreading at anthesis, oblong-elliptic to ovate-elliptic becoming spathulate when dry, cucullate distally, 2 5—4 8 X 1 5—3 mm, marginally entire, apically rounded, glabrous, greenish white, stamens 6, filaments basally briefly adnate to the petals, ovary rudimentary **Pistillate flowers** spreading to ascending, floral bracts shorter than to exceeding the sepals, rugulose proximally, chartaceous to cartilaginous especially proximally, occasionally membranaceous distally, narrowly ovate to broadly ovate or oblong-ovate, convex, 3—6 X 3—5 5 mm, marginally hyaline and entire to finely spinulose or erose, apically apiculate to spinulose, glabrous to lepidote, pedicels articulated with the rachis, stout, triqueterous, 1—2 mm long, glabrous to lepidote, sepals subimbricate, triangular to ovate-triangular, 2—3(—4) X 1 2—2 5(—3 5) mm, marginally entire, apically rounded to acute, apiculate or praemorse, glabrous or rarely weakly lepidote, petals suberect, narrowly ovate to triangular, 3—4 5(—5 5) X 1 5—2 8 mm, apically rounded to spinulose-tipped, stamens rudimentary, ovary largely superior, glabrous **Capsules** with stout pedicels 1 5—2(—3 5) mm long, woody, loculicidally and septicidally dehiscent, ovoid, 7—9(—11 5) X (3—)4—5(—6) mm, glabrous, smooth or somewhat reticulate

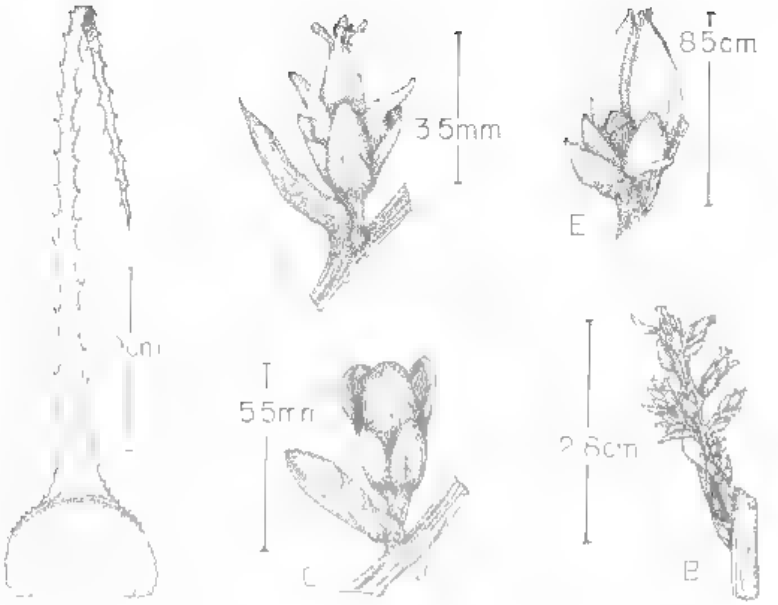

Figure 3 *Hechtia oaxacana* A. Leaf B. Lateral branch of pistillate inflorescence C. Staminate flower just prior to anthesis D. Pistillate flower at anthesis E. Capsule (A, B, C, D from *Utley & Utley 7960* E from *Utley & Utley 7957*)

Distribution and habitat. Known only from northern Oaxaca between 5400 and 7800 ft, where it grows on steep karstic slopes with secondary vegetation and remnant *Quercus, Pinus, Juniperus,* and occasionally *Ephedra.*

Phenology. Flowering specimens have been collected in April, May, July, and August. On the herbarium label of *Webster et al. 13018* is the notation that flowers of *Hechtia oaxacana* are visited by bees and wasps. This is consistent with our observations of a number of *Hechtia* species. In addition to bees and wasps, a variety of insects including butterflies, flies, and beetles are common visitors to open staminate and pistillate flowers, which provide rewards of nectar and pollen or only nectar (pers. obs.).

Individuals of *Hechtia oaxacana* vary greatly in size within the populations surveyed which may result from one or more factors: local differences in substrate conditions, age of the flowering individuals, and genetic variability. Specimens exhibited several-fold differences in leaf size and corresponding ranges in inflorescence length. Similar striking size differences among individuals have been observed in other *Hechtia* species including *H. pumila* Burt-Utley & Utley from Guerrero and in populations of H. *bracteata* and *H. sphaeroblasta* that are discussed later in this paper. It should be noted that individuals in some populations of *H. oaxacana* (*Utley & Utley 8484 & 8943*) produce stolons from axillary buds which then give rise to new rosettes some distance from the parent plant. This character is not unique to *H. oaxacana* and has been observed in other species within *Hechtia,* including *H. pueblensis* described herein, *H. glomerata* Zuccharini, *H. schottii* Baker ex Hemsley, and *H. sphaeroblasta* B.L. Robinson (pers. obs.). In these species, stolon formation varies among populations and cannot be considered diagnostic of these taxa. Inflorescences of *H. oaxacana* are usually densely to very densely flowered and appearing strobiliform, but in some individuals within a population, flowers on the lateral branches occur in verticils or the inflorescences are less commonly laxly flowered. Pubescence is also highly variable among individuals within a population, including the type series, *Utley & Utley 7960.* Within a population, lateral branches, floral bracts, and pedicels range from almost glabrous to lepidote, depending upon the individual examined. Inflorescence and floral characters of *H. oaxacana* most closely resemble those of *H. bracteata* in their conspicuous floral bracts, but *H. oaxacana* can be distinguished readily from this latter species by its shorter primary bracts [(0.7–)1.5–2.5(–3.8) cm vs (1.2–)2.5–8(–11) cm long], generally smaller staminate sepals [1.2–2.5(–3.5) mm vs (2–)3–4.5(–5) mm long] and shorter pistillate floral bracts [3–6 vs (6–) mm vs 7–9(–12) mm].

Additional specimens examined. **MEXICO. Oaxaca.** N-central Oaxaca on steep slopes and calcareous hillsides, 7800 ft, 26 Jul 1987, *Utley & Utley 7951* (MEXU, USF, XAL); *Utley & Utley 7952* (USF); 4 mi N of Teposcolula at Zocalo on MEX 125, 7700 ft, 26 Jul 1987, *Utley & Utley 7957* (GH, K, M, MEXU, US, USF, XAL); MEX 125 to Tlaxiaco ca 6.6 km S of jct of MEX 190 with MEX 125, 7100 ft, 20 May 1990, *Utley & Utley 8485* (CAS, IBUG, MEXU, NY, US, USF); *Utley & Utley 8943* (MEXU, MICH, NY, US, USF); *Utley & Utley 8969* (GH, MEXU, NY, US, USF); limestone slopes in woodland with *Juniperus* and *Quercus,* 5400—5500 ft, 16 Aug 1962, *G. Webster et al. 13018* (GH, MEXU, US).

4. HECHTIA PUEBLENSIS Burt-Utley, Utley, & García-Mendoza, sp. nov. **TYPE. MEXICO. Puebla.** between 1.1 and 4.9 mi S of Zapotitlán on MEX 125 from Tehuacán to Huajuapan de León. Rocky soil on exposed, dry slopes with thorn-scrub vegetation, 5500—5700 ft, 25 Jul 1987, *J. Utley & K. Utley 7948* (holotype: ♀ and ♂ MEXU; isotypes: B, BM, CAS, CU, GH, M, MICH, MO, NY, TEX, US, USF, XAL). Figure 4 and Figure 5.

Planta florens 0.3—0.45 m diam et 15.3—21.1 dm alta; folia multa; lamina supra glabram. Inflorescentia terminalis. Florum masculorum pedicelli 1.5—2.5 mm longi; bracteae florales pedicellum et sepala excedentes glabrae; sepala late ovata vel ovato-triangularia 2.3—3 mm longa et 2—2.5 mm lata. Florum femineorum pedicelli 1.5—3 mm longa glabri; bracteae florales pedicellum excedentes ovata ad late ovata, 2.5—4.5(—6) mm longa et 2—3(—5) mm lata, petala ovata-triangularia ad triangularia, 3—4 mm longa et 1.5—2.4 mm lata. Capsulae ovoideae 7—8.5mm longa et 4—5.5 mm diam.

Plants in flower with rosettes 0.3—0.45 m diam and inflorescences to 15.3—21.1 dm high, usually in large colonies to 5—10+ m diam. Rosettes producing stout stolons. **Leaves** very numerous, spreading to subascending, 33—39 cm long; sheaths on older leaves 3.2—5.2 X (5.1—)6.3—9.2 cm, glabrous above but lepidote distally beneath, marginally aggressively spinose; blades straight to weakly falcate, triangular, 2.8—3.5 cm wide above the sheath, the margins armed with antrorse, retrorse and spreading red-brown tips 1.3—2.5 cm apart and the tips 3—4 mm long, glabrous and lustrous above but sparingly lepidote above the blade-sheath junction, lepidote below. **Inflorescences** terminal, in staminate individuals often twice compound, but in pistillate individuals once or twice compound, when twice compound both usually with 2 basal branches arising from or near the axis of the inflorescence and bordering the primary branch and occasionally 1 or more additional secondary branches; scape stout, to 99+ cm long, (0.8—)1.5—3.1 cm diam, glabrous; lowermost scape bracts numerous, foliaceous, ascending, 23—33 cm long with linear-triangular aggressively spinose blades; upper scape bracts generally longer than the internodes, lance-ovate with adpressed linear-triangular blades (2.4—)3—16.5 cm long; rachis (4.8—)7.5—10.6 dm long, glabrous; primary bracts shorter than all but the shortest lateral branches, (1.9—)2.5—10.3 cm long, marginally finely spinulose, glabrous above but finely lepidote below; lateral branches sulcate, fertile throughout, those of staminate inflorescences spreading to subascending, sometimes falcate, 5.6—12 cm long, densely to very densely many-flowered throughout, glabrous, those of pistillate inflorescences subascending to ascending, straight or weakly falcate, (3.5—)7.5—23(—38) cm long, densely flowered, the flowers sometimes verticillate. **Staminate flowers** spreading to subascending; floral bracts generally exceeding the sepals, cartilaginous to chartaceous, ovate to broadly ovate or ovate-triangular, convex and keeled, 3.5—8 X 3—5 mm, externally glabrous, marginally entire to erose distally, apically acuminate to attenuate-acuminate; pedicels articulated with the rachis, stout, 1.5—2.5 mm long, glabrous; sepals convex and at least one cucullate distally, broadly ovate, 2.3—3 X 2—2.5 mm, marginally erose to finely spinulose, apically rounded to praemorse, lustrous and glabrous; petals spreading at anthesis, oblong-elliptic to ovate-elliptic becoming spathulate when dry, 3.5—5 X 2—2.6 mm, marginally entire, apically rounded, glabrous, pale cream; stamens 6, with filaments basally briefly adnate to the petals; ovary rudimentary. **Pistillate flowers** subsecund and generally ascending; floral bracts shorter than to equaling or exceeding the sepals and much of the petals, chartaceous to coriaceous especially proximally, marginally hyaline, ovate to broadly ovate, convex, 2.5—4.5(—6) X 2—3(—5) mm, marginally entire to very finely erose to denticulate, especially distally, apically acuminate to apiculate, glabrous; pedicels articulated with the rachis, stout, 1.5—3 mm long, glabrous; sepals coriaceous especially post-anthesis, marginally broadly hyaline, weakly overlapping, convex, triangular to ovate-triangular, 1.8—2.4(—3.3) X 1.5—2.5(—3.2) mm, marginally finely erose to entire, apically rounded to praemorse or apiculate, glabrous; petals subspreading, ovate-triangular to triangular, 3—4 X 1.5—2.4 mm, apically rounded to praemorse or apiculate; stamens rudimentary; ovary largely superior, glabrous. **Capsules** with stout pedicels 1.5—3.5 mm long; cartilaginous, loculicidally and septicidally dehiscent, ovoid, 7—8.5 X 4—5.5 mm, glabrous, somewhat rugulose, yellow-brown.

Distribution and habitat Known only from the vicinity of the type locality in Puebla, where it forms large populations on extremely dry, exposed slopes and hillsides with low thorn-scrub vegetation and tall, columnar cacti as well as other cacti

Figure 4. *Hechtia pueblensis*. Isotype of part of a staminate inflorescence (from *Utley & Utley 7948*, USF)

Figure 5. *Hechtia pueblensis*. Isotype of a leaf and branch of pistillate inflorescence (from *Utley & Utley 7948*, USF).

A brief characterization of the pistillate material of *Hechtia pueblensis* was included in the ample description of *H. tehuacana* (Robinson 1904). On all specimens from the type series of this taxon examined (*Pringle 8578*, CU, F, GH, LL, MEXU, US), there is a small branch of pistillate or capsular material or both, as well as a leaf and a part of a staminate inflorescence. Apparently when Pringle collected this material, he removed lateral branches from a pistillate inflorescence well post-anthesis, as well as lateral branches from an individual with better developed capsules, and then branches from a staminate individual. Leaves are all from the same specimen, as judged by their size, spines, and pubescence and are presumably from a staminate plant because of the differences in leaf pubescence mentioned previously. Since the major portion of Robinson's description focused on vegetative and staminate material, the pistillate material well post-anthesis is recognized as a distinct species herein, *H. pueblensis*, while the staminate material is within the variation observed for some populations of *H. podantha*, with which it was synonymized (Smith 1937). Herein, *H. tehuacana* is lectotypified by the staminate material and leaf present on *Pringle 8578* at GH. In the type series of *H. tehuacana*, staminate pedicels are a bit shorter than those observed in populations of *H. podantha* that we collected from Hidalgo, Morelos, and Puebla. Moreover, our collections reveal potentially minor differences in lateral branch form and robustness, pedicel length, and floral bract length and shape among the numerous populations of *H. podantha* we sampled. Some of this variation could readily be related to the extreme environments where the species occurs. *Hechtia podantha* sensu lato is in need of further study to assess the significance of observed differences and this research is currently in progress. Although *H. tehuacana* was included in the *podantha* species complex (Martínez-Correa et al. 2010) based on the mixed type, the authors failed to realize that the pistillate material represents a distinct species (*H. pueblensis*) and compared their new species, *H. chihuautzensis* Martínez-Correa, Espejo, & López-Ferrari and *H. colossa* Martínez-Correa, Espejo, & López-Ferrari to *H. tehuacana* as circumscribed by Robinson (1904). Moreover, when they compared floral characters among the included taxa, they failed to distinguish between staminate and pistillate inflorescences and their flowers in their table. Because of dimorphisms known to exist between the sexes in species we have collected in flower, it is absolutely essential to compare like parts (Burt-Utley & Utley 1993).

Additional specimens examined. **MEXICO. Puebla**. Ca San Gabriel Chilac near San Juan Atzingo and San Andrés, ca 1500 m, 24 Jul 1961, *Smith et al. 4026* (F [2], US [2]); Tehuacán, 2 Aug 1901, ♀, pro parte menor, *C. Pringle 8578* (B, BM, GH, K, TEX, M, MEXU); MEX 125 between Huajuapan de León and Tehuacán ca 3.6 mi S of Zapotitlán Salinas, 5400 ft, 16 Jul 1991, *Utley & Utley 8649* (MEXU, USF); 0.8 mi E of MEX 125 on gravel rd to San Luis Atolotitlán, 5300 ft, 17 Jul 1991, *Utley & Utley 8651* (CAS, CU, M, MEXU, NY, US, USF, XAL).

Taxonomic notes.

HECHTIA BRACTEATA Mez, in Alph. de Candolle, Monogr. Phan. 9: 550. 1896. **TYPE. MEXICO. Veracruz.** Orizaba, 1833, *F. Müller 813* (holotype: W; isotype: fragments-B!).

Hechtia confusa L.B. Smith, Contr. Gray Herb. 117: 22. 1937. **TYPE. Mexico. Puebla.** Dry calcareous hills, La Cañada, 1897. *C.G. Pringle 7497* (holotype: GH!).

Hechtia bracteata ranges from Veracruz to adjacent Puebla between 6000 and 8000 ft elevation, where it grows on rocky, dry, exposed hillsides with low thorn-scrub vegetation. In these locations, it is an abundant and often dominant component of the vegetation. Vegetatively, unlike many *Hechtia* species that consist of solitary individuals, *H. bracteata* occurs in clumps of two or more individuals. Lateral branches of both pistillate and staminate inflorescences are very densely flowered on all the specimens we saw or collected.

As interpreted here, *Hechtia bracteata* includes *H. confusa*, which (Smith 1937) described as new because its flowers and pedicels resembled those of *H. podantha* but differed in its ample floral bracts. Plant habit, inflorescence form, floral characters, and capsules of *H. confusa* are indistinguishable from those of *H. bracteata*. The most obvious differences between the holotype of *H. confusa* (*Pringle 7479*) and specimens collected from the vicinity of its type locality (*Utley & Utley 7934*) are shorter leaf blades and far less robust inflorescences than those observed on individuals in populations of *H. bracteata* from elsewhere in Puebla or in Veracruz. Interestingly, the more diminutive colonies occur at slightly higher elevations (1100—1400 ft) and more harsh environments than those of the more robust *H. bracteata* populations. Edaphic factors and differences in moisture availability may influence mature plant size in some populations of *H. bracteata* and this is consistent with our observations of populations of other *Hechtia* species observed from elsewhere in Mexico.

Most recently *Hechtia bracteata* and its synonym *H. confusa* were both included as distinct species in the *H. podantha* complex (Martínez-Correa et al. 2010). Their inclusion in this complex ignores the obviously articulated pedicels and ample floral bracts characteristic of this species that are not evident on the other taxa included in the group and strongly suggests that the circumscription of the complex needs re-evaluation.

Representative specimens examined. **MEXICO. Puebla.** Cerros calizos con matorral espinosa, *Salinas T. F4211* (MEXU); ca 6.3 mi NE of jct of MEX 150 with rd into Tehuacán, 6000 ft, 5 Jul 1982, *Utley & Utley 6931* (MEXU); 4.9 mi N of MEX 150 libre on MEX 28 to Esperanza and 2.9 mi S of Cañada Morelos, 7700 ft, 18 Jun 1987 *Utley & Utley 7911* (MEXU, USF); *Utley & Utley 7934* (C, CAS, GH, MO, NY, XAL); 7700—8000 ft, 21 Jul 1987, *Utley & Utley 7935* (B, GH, M, MEXU, US, USF); 10 Feb 1994, *Utley & Utley 8878* (MEXU); 30.8 mi N of Acatlán on rd from Acatlán to Ixcaquixtla, 6300 ft, 15 Jul 1991, *Utley & Utley 8642* (MEXU). **Veracruz**. 0.2 mi W of Acultzingo on MEX 150 libre to Puebla, 6000—6100 ft, 21 Jul 1987 *Utley & Utley 7912* (GH, M, MEXU, US, USF, XAL); ca 2.2 mi W of Acultzingo on MEX 150 libre to Puebla state line, 6400 ft, 4 Aug 1991, *Utley & Utley 8748* (CAS, GH, MEXU, US, USF, XAL); 6270 ft, 31 May 1992, *Utley & Utley 8785* (B, CAS, GH, MEXU, MICH, NY, US, USF, XAL); 6600 ft, 10 Feb 1994, *Utley & Utley 8879* (MEXU).

HECHTIA SPHAEROBLASTA B.L. Robinson, Proc. Amer. Acad. Arts 35: 323. 1900. **TYPE. MEXICO. Guerrero**. Tlapa, 1200 m, 3 Dec 1894, *Nelson 2044* (holotype: GH!; isotype: US!).

Hechtia sphaeroblasta was thought to be known only from its type from Tlapa, Guerrero, which consists of fragments of a staminate inflorescence and a leaf and was distinguished from *H. stenopetala* Klotzsch by its stamens that were considered to be included rather than exserted (Smith & Downs 1974). Although this species was occasionally collected, pistillate specimens including *Moore 5278* and *Moore & Wood 4737* all were identified as *H. stenopetala* Kl. or *H. podantha* (*Smith & Ruiz Mora 3215a*). In addition to *H. sphaeroblasta*, *H. stenopetala* included elements of several other species, including *H. melanocarpa* L.B. Smith (Burt-Utley & Utley 1988), *H. cordylinioides* Baker, and *H. hintoniana*, which is described herein. Matuda's collection of *H. sphaeroblasta* (*Matuda et al. 38471*) and ours from near Tlapa de Comonfort, Guerrero (*Utley & Utley 8566*), and elsewhere in Guerrero, Puebla, and Oaxaca establish that this species is abundant in a number of different habitats in these Mexican states. Individuals vary significantly in size at flowering among and within populations and in the presence or absence of stolons. *Hechtia sphaeroblasta* grows epilithically on rock faces adjacent to deciduous forests but also terrestrially on calcareous soils in or near deciduous forests and on steep, exposed karstic slopes. Individuals may be solitary or occur in colonies. *Hechtia*

sphaeroblasta is readily distinguished from other taxa by its glabrous, characteristically twice compound pistillate and staminate inflorescences with ascending branches.

Representative specimens examined. MEXICO. Guerrero. Cañon del Zopilote, km 267—268 between Venta Vieja and Milpillas on hwy between Mexcala and Chilpancingo, ca 2000 ft, 23 Aug 1948, *Moore & Wood 4737* (US); Cañon del Zopilote between Mexcala and Zumpango, 1950—2700 ft, 23 Aug 1948, *Moore 5278* (BH, C, US); Xochihuehuetlán, adelante de Tlapa, 1300 m, 15 Aug 1972, *Matuda et al. 38471* (MEXU, US); 1.4 mi W of Tlapa de Comonfort on hwy from Tlapa to Chilpancingo, 3800 ft, 29 Jul 1990, *Utley & Utley 8566* (GH, MEXU, NY, US, USF). **Oaxaca.** alrededores de la Planta Hidroeléctrica 7 km al NW de Tamazulapan, 1750 m, 18 Apr 1965, *Rzedowski 19699* (US); 10.7 mi S of Oaxaca-Puebla state line on MEX 125 from Huajuapan to Tehuacán, 6100 ft, 11 Aug 1986, *Utley & Utley 7623* (CAS, MEXU, USF); between 16.2—17.6 mi N of MEX 190 at Huajuapan de León on MEX 125 from Huajuapan to Tehuacán, 6400—6500 ft, 25 Jul 1987, *Utley & Utley 7946* (GH, MEXU, MICH, US, USF); 6700 ft, 25 Jul 1987, *Utley & Utley 7947* (MEXU, NY, USF, XAL); 15.5 mi SE of Huajuapan de León on MEX 190 to Oaxaca, 7100 ft, 30 Jul 1990, *Utley & Utley 8572* (MEXU). **Puebla.** On hwy from Puebla-Oaxaca, 16 Dec (year not given), *Smith & Ruiz Mora 3215 a* (F); 40 .6 mi S of square at Acatlán on rd to Izúcar de Matamoros, 4000 ft, 9 Aug 1986, *Utley & Utley 7619* (B, BM, CAS, F, GH, K, MEXU, MO, NY, US, USF); 12.7 mi S of on MEX 190 to Acatlán and Huajuapan de León, 4400 ft, 24 Jul 1987, *Utley & Utley 7942* (MEXU, USF); MEX 190,10.3—11 mi NW of Acatlán, 4700—4800 ft, 29 Jul 1990 *Utley & Utley 8569* (C, GH, M, MEXU, MO, NY, USF, XAL); ca 0.6 mi S of Chinantla on rd to Tlapa de Comonfort, 4000 ft, 15 Jul 1991, *Utley & Utley 8643* (GH, MEXU, US, USF).

HECHTIA TEXENSIS S. Watson, Proc. Amer. Acad. Arts. 20: 374. 1895. **TYPE. USA. Texas.** On limestone cliffs in the great bend of the Rio Grande, Aug 1883, *Havard 85* (holotype: GH!; isotype: GH!).

Hechtia elliptica L.B. Smith, Contr. Gray Herb. 117: 20. 1937. **TYPE. MEXICO. Coahuila.** Saltillo, 1898, *Palmer 205* (holotype: GH!; isotypes: BM!, C!, UC, US!).

Hechtia zacatecae L.B. Smith, Contr. Gray Herb. 117: 21. 1937. **TYPE. MEXICO. Zacatecas.** High ridges, Cedros, 1908, *Kirkwood 5* (holotype: GH!; isotypes: F!, MO).

Hechtia texensis is distributed from Texas in the USA to the northern Mexican states of Chihuahua, Coahuila, and Zacatecas. *Hechtia texensis* was distinguished from both *H. elliptica* and *H. zacatecae* using sepal length vs width (shape) as a key character (Smith 1937; Smith & Downs 1974); however, pistillate sepals of *H. texensis* were being compared to staminate sepals of both *H. elliptica* and *H. zacatecae* (Burt-Utley & Utley 1987). When staminate sepals as well as pistillate sepals and capsules of these taxa are compared with one another, it is impossible to distinguish either *H. elliptica* or *H. zacatacae* from *H. texensis*. Smith (1937) and Smith and Downs (1974) further distinguished *H. elliptica* from *H. zacatecae* by sepal characters that were characterized as elliptic and obtuse in *H. elliptica* but ovate and acute in *H. zacatecae*. Both shapes and apices are observed on the type specimens of both taxa. As noted previously, sepal shape within an individual flower in *H. texensis* is variable (Burt-Utley & Utley 1987) and an unreliable character. The sepals of *H. elliptica* were described as deep rose and those of *H. zacatecae* as being stramineous. Sepals on the holotypes of both taxa have minute maroon maculations, but those of *H. elliptica* are denser, giving them a "rose" rather than stramineous appearance. Furthermore, leaves of *H. elliptica* were characterized as being splashed bright rose, while those of *H. zacatecae* were green (Smith 1937; Smith & Downs 1974). When specimens from the type series of *H. elliptica* were examined, it was obvious that the leaf coloration resulted from a pigmented compound that was deposited on their leaf surfaces and also

absorbed into their hypodermises. Our collections from the vicinity of the type locality of *H. elliptica* and near the type locality of *H. zacatacae* all support the synonymy of *H. elliptica* and *H. zacatacae* with *H. texensis*.

Representative specimens examined. MEXICO. Chihuahua. 20 km ENE of Cd. Jiménez, 5100 ft, 2 Oct 1973, *Henrickson 13775* (LL, TEX). **Coahuila.** 8.8 mi NE of Glorietta on N side of Saltillo on MEX 40 between Saltillo and Monterrey, 1410 m, 22 May 1991, *Utley & Utley 8600* (BM, C, F, GH, K, M, MEXU, NY, TEX, UC, US, USF); 18.3 mi NE of glorietta on N side of Saltillo on MEX 40 between Saltillo and Monterrey, 1240 m, 22 May 1991, *Utley & Utley 8601* (BM, C, M, GH, MEXU, MO, TEX, US, USF); 7.5 mi N of glorietta on NW side of Saltillo where MEX 57 and MEX 40 junction on MEX 57 to Monclava, 1460 m, 22 May 1991, *Utley & Utley 8602* (MEXU, TEX, USF); 18.6 mi N of glorietta on NW side of Saltillo where MEX 57 and MEX 40 junction on MEX 57 to Monclava, 1250 m, 22 May 1991, *Utley & Utley 8603* (BM, C, GH, MEXU, US, USF); 22.9 mi W of Saltillo at glorietta on W side of Saltillo where MEX 57 and MEX 40 meet, on MEX 57 toward Torreón, 1340 m, 22 May 1991, *Utley & Utley 8604* (MEXU, US, USF); just N of Coahuila-Zacatecas state line on MEX 54, 16.3 mi N of turnoff to Concepción de Oro, 23 May 1991, *Utley & Utley 8606* (MEXU, USF).

HECHTIA GLOMERATA Zuccharini. Abh. Math. Phys. Cl. Königl Bayer. Akad. Wiss. 3: 240, pl. 6. 1840.

Hechtia mexicana L.B. Smith. Contr. Gray Herb. 117: 19. 1937. **TYPE. MEXICO. San Luis Potosí.** Dept. Valles, Sierra de Abra, 200—300 m, *Maury 6593* (holotype: F!; isotype GH).

Hechtia glomerata is the most widely distributed species in the genus, ranging from southeastern Texas to Guatemala and has been abundantly collected in Texas and in the northern Mexican states of Tamaulipas, Hidalgo, and San Luis Potosí. In *H. glomerata*, like *H. texensis*, inflorescences are lateral and a robust flowering individual may have two or more inflorescences simultaneously with flowers at anthesis (e.g. *Utley & Utley 9005*). Inflorescences in populations of *H. glomerata* also vary from once compound with short densely flowered to elongate laxly flowered lateral branches to twice compound with elongate lateral branches. Aside from field observations, it is possible to unequivocally determine that the inflorescences are lateral when scape bases are available. In both taxa, the lowermost scape bracts are very short, unlike those of species with terminal inflorescences that typically have foliose lowermost scape bracts.

Hechtia glomerata was distinguished from *H. mexicana* using flower size as a key character (Smith 1937; Smith & Downs 1974). However, the measurements taken from the type of *H. mexicana*, which consisted of an inflorescence branch with mature capsules, included the length of the capsules, in contrast to those of *H. glomerata*, which were based on actual flower size. The size of floral bracts, sepals and the remains of petals from *H. mexicana* are consistent with those obtained from *H. glomerata*; moreover, there are no significant differences in the shapes of these parts when individuals of the same sex are compared from the type locality of *H. mexicana* and populations of *H. glomerata* from throughout its range. Differences in diameters of individuals at flowering, heights of inflorescences, as well as lengths of lateral branches can be observed readily within populations of *H. glomerata* but are likely the result of local edaphic factors, age of flowering individuals, and genetic variability. Our collections (*Utley & Utley 7838*) from the vicinity of the type locality, Sierra del Abra in the state of San Luis Potosí, support these findings as do inflorescence and floral characters from our collections of *H. glomerata* from the states of Tamaulipas, San Luis Potosí, and elsewhere in Mexico.

Representative specimens examined. **MEXICO. Tamaulipas.** Cerro Tres Vetas, 16 Jul 1930, *Bartlett 10383* (US); 16 m S of Cd Victoria at junction of Cd Victoria-Matamoros hwy with Periférico on rd to Cd Mante,1200 ft, 23 May 1987, *Utley & Utley 7835* (F, MEXU, USF); Sierra Cucharas, 1100 ft, 23 May 1987, *Utley & Utley 7836* (MEXU, MO, TEX, USF); 10.8 mi S of Cd Mante on hwy to Cd Valles, 900 ft, 23 May 1987, *Utley & Utley 7837* (MEXU, USF); ca 1 mi S of El Abra on MEX 85 from Cd Mante to Cd Valles, 800 ft, 20 Apr 1995, *Utley & Utley 9005* (GH, M, MEXU, TEX, US, USF); ca 1.7 mi S of rd from MEX 85 to Gómez Farías on gravel/dirt rd to Balneario La Florida, 400 ft, 23 May 1994, *Utley & Utley 8928* (GH, MEXU, M, TEX, USF). **Hidalgo.** Jacala, Puerto de la Zorra near km 284 on hwy N of Jacala, 1500 m, 27 Oct 1946, *Moore 1692* (GH); 10 km al NW de Zimapán, 30 Apr 1965, González Quintero, 2356 (WIS); slopes of barranca de Tolimán somewhat above mines on rd from Zimapán to Mina Loma del Toro and Balcones, 5000 ft, 8 Aug 1948, *Moore & Wood 4400* (MICH, US). **San Luis Potosí.** Estacion Microondas Pastoriza, ca 22 km S of Matahuala, 1550—1650 m, 19 May 1973, *Johnston el al* (LL, TEX); El Abra, ca 15 km E of Cd Valles, 15 Apr 1956, 150 m, *Rzedowski 7474* (MEXU, US); 7.3 mi E of Cd. Valles and 2 mi E of El Abra on MEX 70 from Cd Valles to Tampico, ca 600 ft, 24 May 1987, *Utley & Utley 7838* (K, M, MEXU, US, USF). **Queretaro.** Ca 12.5 mi E of Vizarrón on MEX 120 to Jalpan, 4800 ft, 22 May 1994, *Utley & Utley 8926* (M, MEXU, USF); ca 12.8 mi N of Jalpan on rd from Jalpan to Río Verde, 2200 ft, 22 May 1994, *Utley & Utley 8927* (MEXU). **Chiapas.** Mpio. La Trinitaria, 3 mi S of La Trinitaria, 5100 ft, 10 Jul 1966, *Breedlove 14478* (MICH, US); 5.3 mi S of La Trinitaria on Mex 190, 4200 ft, 22 Jun 1982, 2800 ft, *Utley & Utley 6854* (MEXU, USF); ca 0.8 mi N of Mex 190 on gravel rd to Cascadas El Aguacero, 26 Jun 1982, *Utley & Utley 6876* (MEXU, USF); 3 km N of Ocozocoautla on rd to Mal Paso, 900 m, 1 Feb 1972, *Breedlove 23916* (MICH, MO, NY);13 km N of Berriozabal near Pozo Turpache and Finca Suspiro, 900 m, 25 Dec 1972, *Breedlove & Thorne 30856* (MICH). **GUATEMALA. Dpto. Quiché.** Near Sacapulas, 1040—1240 m, 12—14 Jan 1939, *Standley 62525* (F).

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ADDITIONS TO AND INTERESTING RECORDS FOR THE OHIO VASCULAR FLORA (WITH ONE NEW RECORD FOR INDIANA)

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ABSTRACT

Eighty taxa of vascular plants are reported as either new to the Ohio flora, or represent significant new records for previously rarely reported taxa. New species reported for Ohio include these: *Aesculus pavia*, *Allium tuberosum*, *Bulboschoenus maritimus*, *Bothriochloa bladhii*, *Bothriochloa ischaemum*, *Bothriochloa laguroides*, *Carex austrina*, *Carex cherokeensis*, *Carex complanata*, *Carex divulsa*, *Carex gigantea*, *Carex reznicekii*, *Celtis laevigata*, *Chloris virgata*, *Cotoneaster apiculatus*, *Croton willdenowii*, *Cyperus difformis*, *Egeria densa*, *Eleutherococcus pentaphyllus*, *Elsholtzia ciliata*, *Ginkgo biloba*, *Juniperus sabina*, *Kalopanax septemlobus*, *Kyllinga gracillima*, *Malus baccata*, *Malus prunifolia*, *Medicago minima*, *Pennisetum alopecuroides*, *Phyllanthus tenellus*, *Pinus taeda*, *Prunus armeniaca*, *Quercus phellos*, *Rubus parviflorus*, *Schoenoplectus mucronatus*, *Symplocos paniculata*, *Tsuga caroliniana*, *Ulmus parvifolia*, *Viburnum carlesii*, *Viburnum setigerum*, *Viburnum sieboldii*, and *Zoysia japonica*. New waifs included: *Angelonia angustifolia*, *Bidens pilosa*, *Catharanthus roseus*, *Chamaesyce hirta*, *Cyperus involucratus*, *Emilia sonchifolia*, *Gamochaeta pensylvanica*, *Impatiens walleriana*, *Lagerstroemia indica*, *Metasequoia glyptostroboides*, *Senna obtusifolia*, *Smilax bona-nox*, and *Youngia japonica*. New hybrids are documented for Ohio in *Carex*, *Malus*, *Quercus*, *Sorghum*, *Ulmus*, and *Viburnum*. In addition, *Kalopanax septemlobus* is documented as new for Indiana. Three species, *Juniperus sabina*, *Metasequoia glyptostroboides*, and *Viburnum carlesii*, are new to the flora of North America.

Floristic investigations in Ohio continue to result in new discoveries. The flora of the state consists of nearly 3,000 species (Cooperrider et al. 2001), of which approximately 35% are introductions to Ohio. The percentage of introduced species to aliens is likely to continue to increase as anthropogenic influences on the state increase, and these may have unintended ecological and economic impacts on the state (see for example, an analysis by Pimentel et al. 2001). Continued documentation and study of the flora of Ohio is important as a way to track the impacts of the introduction of new species and losses of others that result from habitat destruction, climate change, and other human impacts. Discovery of new introductions to a flora must be constantly reported so

that potential invasions of new species can be detected early, and so that the spread of potentially weedy taxa can be stopped earlier in the invasion process.

Discovery of these taxa as part of the flora of Ohio resulted from a combination of examination of specimens in herbaria and field work. Some of the taxa listed are likely overlooked native taxa, while others are here as the result of introductions, either intentional or accidental.

CATALOGUE OF NEW OR OTHERWISE INTERESTING PLANT TAXA IN THE STATE OF OHIO, WITH VOUCHER SPECIMENS:

ACER SACCHARUM Marsh. var. *SCHNECKII* Rehder (Aceraceae) – Schneck's sugar maple

Clermont Co.: extreme SE Franklin Twp., one medium-sized, native individual (local in area on upland sites) located along wood-lined fencerow above creek bottom along W edge of Bartlow Rd. (CR 7), 1.38 mi. N of US Rt. 52, Utopia, 18 Jul 2009, *B.P. Riley 1094-1095* (OS); *ibid, B.P. Riley 1096* (MU). **Gallia Co.**: Perry Twp., N central ½ sect. 23 one mature, native tree (ca. 18" DBH) growing on mesic site on W side of Raccoon Creek & on E side of Dan Jones Rd. (CR 28), .15 mi. S of SR 141 on S side of bridge over Raccoon Creek, 1 Aug 2009, *B.P. Riley 1097* (OS); *ibid, B.P. Riley 1098* (MU). **Ottawa Co.**: State Conservation Park, South Bass Island, Lake Erie, 17 Jun 1950, *F.O. Grover A50-2* (OS); *ibid, F. Grover A50-3* (MU); near southwest tip of island about 50 feet due northeast of base of alligator bar, Gibraltar Island, 27 Jul 1967, *H.J. Harlan 4* (OS); Put-in-Bay Twp., Green Island, abundant throughout wooded portion of island, dominant with hackberry, 12 Jul 1969, *T. Duncan 376* (OS); Rattlesnake Island, large tree in the woods near the neck of island, 28 Jul 1970, *M.L. Roberts 627 & K. Foos* (OS).

Schneck's sugar maple is known from several states in the east-central USA, including Indiana and Kentucky (USDA NRCS 2011). It can be distinguished from typical sugar maple by its densely villous abaxial leaf veins and petioles (Fernald 1950). It appears to be a native part of the Ohio flora.

AESCULUS HIPPOCASTANUM L. (Sapindaceae) – Horsechestnut

Wood Co.: Freedom Twp., Wm. Henry Harrison Park, Pembroke, sapling in floodplain woods along Portage River, 4 Jun 2008, *B.P. Riley 828* (MU).

This specimen represents a new county record for this commonly cultivated, though rarely escaping, European species (Cooperrider 1995; Cooperrider et al. 2001).

AESCULUS PAVIA L. (Sapindaceae) – red buckeye

Hardin Co.: Roundhead Twp., NW ¼ NE ¼ sect. 21, one plant (ca. 7' tall) in mesic woods surrounding old home site at 14758 SR 235, N of Roundhead, now owned by Ohio Northern University, 2 May 2005, *B.P. Riley 96, M. Moser & M. Campbell* (OS).

Red buckeye, which is native to the southeastern USA (Gleason & Cronquist 1991), is occasionally cultivated in Ohio as an ornamental. It was not reported for Ohio by Cooperrider (1995) or Cooperrider et al. (2001).

ALLIUM TUBEROSUM Rottler ex Spreng. (Alliaceae) – Chinese chives

Butler Co:, Oxford, weedy at edge of woods N of Formal Gardens, Miami University campus, 7 Sep 2006, *M.A. Vincent 13236* (CANB, MU); Oxford, weedy in flower beds, 7 Sep 2000, *M.A. Vincent 9177* (MU, OSH).

McNeal and Jacobsen (2002) reported the occasionally cultivated Chinese chives from three states and alluded to its establishment in New England. It is used as a pot-herb or spice in Asian cooking.

AMPELOPSIS ARBOREA (L.) Koehne (Vitaceae) – peppervine

Butler Co.: Miami University campus, Oxford, weedy in "palm garden", Upham Hall courtyard, 19 Sep 2003, *M.A. Vincent 13231* (MU). **Clermont Co.**: extreme SW Franklin Twp., local population vigorously growing on and over woody vegetation near NE edge of young, floodplain woods located at SW corner of US Rt. 52 & Hamilton Rd., 0.10 mi. W of SR 222, Chilo, 11 Sep 2010, *B.P. Riley 1412-1413* (OS); *ibid*, *B.P. Riley 1414* (MU).

Though peppervine is listed for Ohio by the USDA Plants database (USDA NRCS 2011), no documentation of this could be located, and so the species is listed here as new to the State. It has been reported for Kentucky (Medley 1993) and is also perhaps found in Indiana (USDA NRCS 2011), though this has not been verified (K. Yatskievych, *pers. com.*).

ANGELONIA ANGUSTIFOLIA Benth. (Scrophulariaceae) – Narrowleaf angelonia

Butler Co.: Oxford Twp., side of road on US Rt. 27, in ditch, 6 Oct 2010, *K. Huntoon 36* (MU).

This record must be considered a waif, since the population did not persist. The species, which is native to Mexico and Central America and is widely cultivated as a bedding plant, is reported from two counties in Florida (Wunderlin & Hansen 2008), though no other reports of it as an escape can be found.

BIDENS PILOSA L. (Asteraceae) – Hairy beggarticks

Butler Co.: Oxford, weed in garden, 23 Sep 1997, *M.A. Vincent 8008* (BAYLU, F, MO, MU, OS, WS).

This species, which is native to Mexico and Central America, is found throughout the Caribbean and southeastern USA and occasionally as far north as Pennsylvania, Ontario, and Quebec (Ballard 1986; Strother & Weedon 2006). If one follows Ballard (1986) rather than accepting the broader species circumscription of Strother and Weedon (2006), this specimen will key out to *B. alba* (Linn.) DC. var. *radiata* (C.H. Schultz-Bip.) Ballard. This record must be considered adventive (a waif), since the population did not persist.

BOLBOSCHOENUS MARITIMUS (L.) Palla (Cyperaceae) – salt-marsh bulrush

Adams Co.: Franklin Twp., local, 3 x 5 m. colony in median of St. Rt. 32 at the jct. with St. Rt. 73, 5 Jun 2010, *R.L. Gardner 6814 & C. Harner* (MICH, OS).

Bolboschoenus maritimus is a halophyte from Asia and Europe and now occurs throughout most of North America (Smith 2002a). Another small colony was found in the median of State Route 32 in Adams County within a few miles from the collection site. Mowers will aid in spreading this species along Ohio's highways. Ohio collections are apparently all subspecies *paludosis* (A. Nels.) T. Koyama.

BOTHRIOCHLOA BLADHII (Retz.) S.T. Blake (Poaceae) – Caucasian bluestem

Greene Co.: Beaver Creek Twp., local, ca. 25 sq. ft. area, in created prairie; Mount St. John N. of Shakertown Rd. & W. of I-675, 2 Oct 2008, *R.L. Gardner 6074, D. Geiger & M. Banker* (MICH, OS).

Bothriochloa bladhii is a western species with rare occurrences eastward (Allred 2003; Gleason & Cronquist 1991). It was likely introduced to Ohio from a prairie seed mix utilized in the creation of a prairie in the Dayton area.

BOTHRIOCHLOA ISCHAEMUM (L.) Keng (Poaceae) – yellow bluestem

Pickaway Co.: Harrison Twp., sect. 23, local in median of U.S. Rt. 23, 16 Oct 2011, *R.L. Gardner 7179* (OS). **Portage Co.**: Charlestown Twp., roadside, Camp Ravenna Joint Military Training Center, 12 Jul 2010, *R.L. Gardner 6876* (OS); Charlestown Twp., occasional roadside lawns for about 0.5 mi. along Newton Falls Rd. W of Greenleaf Rd., Ravenna Training and Logistics Site, 1 Sep 1998, *R.L. Gardner 2229* (OS). **Ross Co.**: Springfield Twp., NW ¼ sect. 6, local in mowed lawn at St. Rt. 159 exit off of southbound U.S. Route 23, 3 Oct 2008, *R.L. Gardner 6077* (OS).

The 1998 specimen was originally identified as a variety of *Miscanthus sinensis*. *Bothriochloa ischaemum* was likely introduced to Camp Ravenna by train coming from western USA, where it is more commonly found; it is native to Eurasia (Allred 2003).

BOTHRIOCHLOA LAGURIODES (DC.) Herter (Poaceae) – bearded white grass

Franklin Co.: City of Columbus, frequent in median and adjacent road bank on southbound side of IR-71, 14 Sept 2011, *R.L. Gardner 7158* (OS). **Marion Co.**: Grand Prairie Twp., NW ¼ sect. 35, locally common in median of U.S. Rt. 23, 27 Aug 2011, *R.L. Gardner 7145* (MU, OS).

Bothriochloa laguriodes is spreading eastward along major highways and likely been in Ohio for at least 5 years. This species also occurs in the median of IR-675 in City of Beavercreek, Greene County.

BUDDLEJA DAVIDII Franch. (Buddlejaceae) – Butterfly bush

Adams Co.: Sprigg Twp., SE-facing slope on US Rt. 52, SSW of Yates Rd., 2 Aug 2008, *B.P. Riley 855* (MU). **Butler Co.**: Oxford, Miami University campus, weedy along edge of driveway, 1 Dec 2004, *M.A. Vincent 12325* (MU); *ibid*, 12 Aug 2011, *M.A. Vincent 15654* (MU, NY, OS); Oxford, field, 1 Oct 2010, *R. Butler 16* (MU), Oxford, Miami University Natural Areas, 27 Sep 2010, *K. Huntoon 9* (MU); *ibid., K. Huntoon 10* (MU). **Darke Co.**: Greenville, weedy in cracks along Wayne Ave., 27 Nov 2004, *M.A. Vincent 12324* (MU). **Washington Co.**: Marietta Twp., on boulders along St. Rt. 7, frequent local escape, 19 Aug 2008, *R.L. Gardner 6000* (OS).

These reports represent new county records for this increasingly common invasive species.

CAREX AUSTRINA Mackenzie (Cyperaceae) – southern sedge

Adams Co.: Green Twp., rare, 3 plants in sandy field with *Opuntia humifusa*, W. of Sandy Springs Cemetery, N. of US Rt. 52, 27 Jul 2009, *R.L. Gardner 6463 & L. Henry* (MICH, MU, OS).

Carex austrina occurs in south-central USA and into northern Mexico. In 2009, population of 3 vigorous plants was discovered in a disturbed black oak sand barren in the Ohio River Valley. The population occurs in abandoned sandy field, associates include *Galactia volubilis, Opuntia humifusa, Cyperus lupulinus, Asclepias amplexicaulis, Eragrostis spectabilis*, and *Schizachyrium scoparium*, with rarities *Krigia virginica, Draba brachycarpa, Carex reznicekii*, and *Carex mesochorea*. The closest populations to Ohio are in northern Tennessee and perhaps southern Kentucky (Ball 2002a).

CAREX CHEROKEENSIS Schweinitz (Cyperaceae) – Cherokee sedge

Erie Co.: Kelleys Island Twp., rare, 2 colonies in red cedar woodland, Kelleys Island State Park, 5 Jun 2008, *R.L. Gardner 5778 & T. Arbour* (MICH, OS).

This is the first record in Ohio for this short-creeping, rhizomatous perennial. Its stout rhizome with its conspicuous remnant leaf bases is diagnostic. This is by far the northernmost population, with the closest population in north central Kentucky (McKinnney et al. 2000; Waterway 2002). This population includes 2 small clones in a former pastured alvar now part of Kelleys Island State Park. *Carex cherokeensis* was likely accidently introduced to the island. The population is stressed from over-shading by *Juniperus virginiana* and the non-native *Elaeagnus umbellata*.

CAREX COMPLANATA Torrey and Hooker (Cyperaceae) – flattened sedge

Athens Co.: Dover Twp., rare, 5 clumps; open oak woods on upper slope of moderately steep SSE.-facing hillside, 0.67 mi. NW. of BM 665, 29 May 2008, *R.L. Gardner 5767* (MICH, MU, OS). **Gallia Co.**: Greenfield Twp., sect. 14, infrequent, 11 to 50 plants; dry, upland woods, Wayne National Forest, 18 May 2010, *R.L. Gardner 6767* (OS).

Carex complanata occurs mostly in the southeastern USA, reaching its northern limit in Iowa (Ball 2002b). It is very similar to *Carex hirsutella* and *C. careliniana*. These are the first confirmed occurrences of *Carex complanata* for Ohio. It is likely more frequent in Ohio than currently known.

CAREX DIVULSA Stokes (Cyperaceae) – grassland sedge

Erie Co.: Kelley's Island Twp., local in red cedar woodland, 0.3 mi. NW. of jct. of Morgan Rd. & Woodford Rd., Kelleys Island State Park, 5 Jun 2008, *R.L. Gardner 5791 & T. Arbour* (MICH, MU, OS).

Carex divulsa is a species native to Eurasia and is naturalized in Ontario (Canada), D.C., Pennsylvania (Ball 2002a), and now Ohio. It was discovered on Ohio's largest island, Kelley's Island, in a *Juniperus virginiana* dominated woodland. This sedge is sold as an ornamental ground cover, which may increase its frequency in Ohio.

CAREX GIGANTEA Rudge (Cyperaceae) – large sedge

Gallia Co.: Greenfield Twp., NE. ¼ sect. 14, infrequent, ca. 75 plants in shallow depressions S. of Symmes Creek, 8 Jul 2009, *R.L. Gardner 6370* (MICH, MU, OS).

Carex gigantea is a loosely cespitose or long-rhizomatous perennial with erect culms. It is infrequent throughout majority of its range from the Atlantic Coastal Plain up the Mississippi and Ohio River valleys (Reznicek 2002). A population was discovered at the Ironton Ranger District of the Wayne National Forest. The site is an *Acer saccharinum-Betula nigra-Quercus palustris-Carya laciniosa-Liquidambar styraciflua* bottomland swamp forest with numerous shallow sloughs. Hundreds of culms were found growing in association with *Carex louisianica, C. lupuliformis, C. intumescens, C. grayi, C. lurida, C. tribuloides, C. typhina, C. squarrosa, C. lupulina, Isoëtes engelmannii, Proserpinaca palustris, Saururus cernuus, Campsis radicans, Ranunculus flabellaris, Panicum rigidulum,* and *Sium suave. Carex gigantea* is currently listed as endangered in Ohio (ODNR 2010).

CAREX GRAYI Carey × *CAREX INTUMESCENS* Rudge (Cyperaceae)

Gallia Co.: Greenfield Twp., rare, floodplain wet woods with *Carex grayi, C. intumescens, C. tribuloides, C. lupulina,* & *C. squarrosa*, Symmes Creek, 9 Aug 2009, *R.L. Gardner 6491, J. McCormac & R. Showman* (CLM, MICH, MU, OS).

This is the first record of this hybrid in Ohio. Parent species were common in a *Acer saccharinum-Betula nigra-Quercus palustris-Carya laciniosa-Liquidambar styraciflua* bottomland swamp forest. On return trips to the site, the hybrid was discovered to be scattered throughout floodplain swamp forest with parent species.

CAREX REZNICEKII Wierer (Cyperaceae) – Reznicek's sedge

Adams Co.: Green Twp., local, 11-50 plants, sandy soils; E. side of main drive into cemetery, center of Sandy Springs Cemetery, 20 Apr 2008, *R.L. Gardner 5681* (MICH, OS); Green Twp., scattered; sandy soil, cemetery, jct. of US Rt. 52 & Twp., Rt. 31A at Sandy Springs, 12 Apr 2001, *Cusick 35,761* (OS). **Jackson Co.**: Jackson Twp., sect. 35, common in dry soil of open oak woods on steep slope, N. side of Twp. Rt. 223 CA. 1 mi., N. of US Rt. 35, 17 Apr 1990, *McCormac 2068* (MU, OS). **Meigs Co.**: Olive Twp., very local on well-drained, exposed, S.-facing slope on N. side of Twp. Rt. 265 on W. side of main headwaters of Forked Run, Shade River Forest, 23 Apr 1990, *Ortt 2862-B* (KE). **Scioto Co.**: Madison Twp., sect. 24, local population on dry, sandy soil within narrow power line clearing running through mature oak woods, S-SE side of Winter Rd. (T-216), 0.925 mi. E-NE of Mt. Carmel Rd. (T-212), 7 May 2011, *B.P. Riley 1886* (OS); *ibid, 1887* (MICH).

Carex reznicekii is a recently described species from the southeastern USA (Weirer 2006). Searches of Ohio herbariums revealed a few specimens from southern Ohio. This species is listed as endangered in Ohio (ODNR 2010).

CATHARANTHUS ROSEUS (L.) G. Don. (Apocynaceae) – Madagascar periwinkle

Preble Co.: Israel Twp., sect. 29, weedy in gravel parking lot at Camp America, Camden-College Corner Rd., 29 Oct 2000, *M.A. Vincent 9189* (MU).

Madagascar periwinkle is commonly cultivated in Ohio as an annual bedding plant (Cooperrider 1995) but has not been previously reported in the state as an escape. In this case, 12 plants were found growing in the gravel parking lot, which was near a building where the species had been cultivated a year or two before. The species, native to the Island of Madagascar, has become a pantropical weed. Many cultivars exist, and are commonly used as bedding annuals. In the USA,

Catharanthus roseus is known to have naturalized in Florida and is encountered as an escape as far north as North Carolina and Tennessee (Weakley 2011).

CELTIS LAEVIGATA Willd. var. *LAEVIGATA* (Ulmaceae) – sugarberry

Clermont Co.: extreme SE Franklin Twp., one young, native individual (up to 2.38" DBH x ca. 23' tall) located along wood-lined fencerow on upland site above creek bottom along W edge of Bartlow Rd. (CR 7), 1.38 mi. N of US Rt. 52, Utopia, 21 Sep 2007, *B.P. Riley 637-638* (OS), *639-640* (MU); extreme SW Pierce Twp., two mature, native trees (largest 29.60" DBH) growing in mature, mesic woods on SE-facing slope above Ohio River, located at 530 Old US Highway 52, .90 mi. W-NW of SR 743, New Richmond, 24 May 2009, *B.P. Riley 1171-1172* (OS), *1173-1174 & M. Wessel* (MU).

CELTIS LAEVIGATA Willd. var. *SMALLII* Sarg. (Ulmaceae) – sugarberry

Clermont Co.: extreme SW Franklin Twp., one mature, native tree (16.0" DBH × ca. 50' tall) and several clonal saplings along S edge of US Rt. 52, .75 mi. E of Bear Creek Rd. (T-15), Chilo, 14 Jul 2007, *B.P. Riley 630-631* (OS); *ibid, B.P. Riley 632* (MU); *ibid,* 28 Jul 2007, *B.P. Riley 633* (OS); *ibid,* 18 Aug 2007, *B.P. Riley 634* (OS); *ibid,* 7 Sep 2007, *B.P. Riley 635 & B. L. Weber* (MU); *ibid,* 19 Jul 2008, *B.P. Riley 878-880* (OS), *881-882* (MU), *883* (BHO), *886-887* (OS); *ibid,* 6 Sep 2008, *B.P. Riley 888* (MU).

CHLORIS VIRGATA SW. (Poaceae) – Feather finger grass

Hamilton Co.: Whitewater Twp., NW ¼ sect. 21, local, about 100 plants, roadside berm, U.S. Rt. 50, 5 Sep 2011, *R.L. Gardner 7, B. Riley & D. Boone* (MU, OS). **Washington Co.**: Warren Twp., Village of Constitution, along roadside berm, E. bound St. Rt. 7, Blues Knob Rd., ca. 500 ft. S. of BM 607, 18 Sep 2009, *R.L. Gardner 6057* (MU, OS).

Chloris virgata is a spreading to erect annual, native to tropical America and is now widespread in southwestern USA and scattered eastward (Barkworth 2003a; Gleason & Cronquist 1991). No plants were observed at the Washington County site in 2010. This species will likely be found more frequently along roadsides in southern Ohio.

COTONEASTER APICULATUS Rehder & E.H. Wilson (Rosaceae) – Cranberry cotoneaster

Pickaway Co.: Washington Twp., NE ¼ SE ¼ sect. 10, one non-fruiting escaped individual (ca. 2' tall) located on E edge of Hargus Lake in mesic woods within AW Marion State Park, 22 Sep 2006, *B.P. Riley 431* (OS).

Cranberry cotoneaster has been reported from Kentucky (Medley 1993) and Pennsylvania (Rhoads & Block 2000) as cultivated and rarely escaping.

CHAMAESYCE HIRTA (L.) Millsp. (Euphorbiaceae) – Pillpod sandmat

Butler Co.: Oxford, Miami University campus, weedy in "palm garden", Upham Hall courtyard, 19 Sep 2003, *M.A. Vincent 11423* (MU); *ibid*, 15 Oct 2004, *M.A. Vincent* 12322 (MO, MU, OS).

This species (also known as *Euphorbia hirta* L.) was introduced as a weed with cultivated plants brought in from the Southeast and persisted at this site from 2002 through 2006. It is rarely found in northern regions of the USA, though it is common in the southern tier of states.

CROTON WILLDENOWII G.L. Webster – Willdenow's croton

Jackson Co.: Bloomfield Twp., local, 11-25 plants in abandoned quarry, 24 Sep 2011, *R.L. Gardner 7169 et al.* (OS, MU).

The site is a highly disturbed area; however, many native species exist in the quarry and this is likely a native population.

CYPERUS DIFFORMIS L. (Cyperaceae) – variable flat-sedge

Delaware Co.: City of Delaware, locally common and likely introduced in mitigation bank wetland, 13 Aug 2011, *R.L. Gardner 7124* (CLM, MICH, MU, OS, OWU).

This is the first record for Ohio of this common weed of rice fields around the world. It was discovered in North America in 1934 (Fernald 1935). Tyndall (1983) suggested the species is spread by birds. The introduction of the Ohio population was likely from contamination of a wetland seed mix.

CYPERUS INVOLUCRATUS Rottb. (Cyperaceae) – Umbrella plant

Butler Co.: Oxford, Miami University campus, weedy in sidewalk cracks outside greenhouse, 16 Oct 2002, *M.A. Vincent 10888* (MU).

This is an unusual record for this far north. These plants were escapes from a greenhouse and grew in cracks of the sidewalks, persisting here for several years, only disappearing when new concrete was laid down. While umbrella plant has been reported as far north as New York, this east African native has formed naturalized populations only in the most southern of USA states (Tucker et al. 2002).

DYSPHANIA PUMILIO (R. Brown) Mosyakin & Clemants (Chenopodiaceae) – clammy goosefoot

Butler Co.: Oxford, weedy in gravel at store parking lot, 15 Jun 2011, *M.A. Vincent 15577* (MU, NY); *ibid*, weedy in flower beds and among shrub plantings along Walnut St. near College Ave., 19 Oct 2011, *M.A. Vincent 15667* (MO, MU, OS, OSH).

Clammy goosefoot, which is native to Australia, is found in widely scattered areas in North America with increasing frequency (Clemants & Mosyakin 2003; Gleason & Cronquist 1991; Poindexter et al. 2011). These are the second and third collections from Ohio. Wilder and McCombs (2002) reported it from Cuyahoga County (as *Chenopodium pumilio* R. Br.).

EGERIA DENSA Planch. (Hydrocharitaceae) – Brazilian water-weed

Clermont Co.: Miami Twp., Milford, Cincinnati Nature Center, in ponds, 30 Jul 1990, *M.A. Vincent et al. 3966* (GB, MU, NLU).

Brazilian water-weed is widely distributed in the USA, even though all know populations in this country are staminate and evidently distributed by birds, watercraft, and through the aquarium

trade (Haynes 2000). The origins of this population are unknown, though it has persisted here for many years.

ELEUTHEROCOCCUS PENTAPHYLLUS Nakai (Araliaceae) – Fiveleaf Aralia

Butler Co.: Oxford, Miami University, Western campus woods, 23 May 1985, *M.A. Vincent & D.D. Taylor 560* (MU); *ibid, D.D. Taylor 8702* (MU); Oxford, Miami University, seedlings & saplings, Bishop Hall, 8 Sep 2000, *M.A. Vincent & J. Woo 9179* (MU); Oxford, Miami University, woods E of Marcum Conference Center, 14 Sep 2010, *M.A. Vincent & Z. Li 15224* (MU). **Hamilton Co.**: Cincinnati, Ault Park, Observatory Ave., west of main park area on west side of road immediately south of weeping cherry plantings, 15 May 2010, *J. Godby & S. Castellano s.n.* (MO, MU, NY).

Eleutherococcus pentaphyllus (formerly known as *Acanthopanax sieboldianus* Makino), which is native to Japan (Rehder 1947), is an occasionally cultivated spiny shrub that sometimes escapes. It is now found in several states in the USA, including Indiana, Kentucky, West Virginia, and Pennsylvania (USDA NRCS 2011).

ELSHOLTZIA CILIATA (Thunb.) Hyl. (Lamiaceae) – crested latesummer mint

Hocking Co.: Good Hope Twp., NW ¼ SW ¼ SW ¼ sect. 26, locally common weedy species growing on E & W edge of gravel roadside next to yellow Hidden Driveway sign on E side of road, subjected to full-near full sunlight & rather far removed from any yards or cultivated areas in remote area along Donaldson Rd. (TR 121), .95 mi. S of SR 374, Rockbridge, 8 Oct 2010, *B.P. Riley 1554-1555* (OS); *ibid, B.P. Riley 1556* (BHO); *ibid, B.P. Riley 1557* (MICH); *ibid,* 16 Oct 2010, *B.P. Riley 1384* (DAWES); *ibid, B.P. Riley 1558* (MU).

The Asian *Elsholtzia ciliata* is known from eastern Canada and northeastern USA, as far west as Manitoba and North Dakota, and south to North Carolina (Gleason & Cronquist 1991; USDA NCRS 2011), often in moist areas.

EMILIA SONCHIFOLIA (L.) DC. (Asteraceae) – Lilac tasselflower

Butler Co.: Oxford, Miami University campus, weedy in "palm garden", Upham Hall courtyard, 19 Sep 2003, *M.A. Vincent 11422* (MU).

Emilia sonchifolia is a pantropical weed, originally native in Asia. In the USA, it is known only from the extreme southeastern states (Barkley 2006). This waif was found in an area where plants were brought in from the Carolinas for cultivation, and appeared as a weed in 2002, and again in 2003 and 2004. It has not been seen here since.

GAMOCHAETA PENSYLVANICA (Willd.) Cabrera (Asteraceae) – Pennsylvania cudweed

Butler Co.: Oxford, weedy in garden, 8 Sep 2009, *M.A. Vincent 14564* (MU).

According to Nesom (2006), Pennsylvania cudweed is native in the southeastern states in the USA, along the Gulf Coast and Atlantic seaboard. It is found as far north as Pennsylvania. This plant was found as a waif in a garden and was perhaps introduced with bedding plants.

GINKGO BILOBA L. (Ginkgoaceae) – Ginkgo, Maidenhair tree

Butler Co.: Oxford, Miami University campus, weedy under shrubs, NE of Ogden Hall, 15 May 2000, *E.J. Tepe 1652* (MU); *ibid*, 8 Sep 2011, *M.A. Vincent 15663* (MU, NA, NY, OS). **Hamilton Co.**: Cincinnati, amongst thick English ivy and under *Lonicera maackii*, Temple Ave., 2 Nov 2002, *F.T. Farruggia 213* (MU, NA, OS).

Ginkgo, an ancient genus once found across North America and Asia, is now only natively found in parts of China (Whetstone 1993). While widely cultivated, it has apparently escaped rarely, and is reported for 6 states in the eastern USA. These Ohio records are all of seedlings and saplings near ovulate trees.

ILEX CRENATA Thunb. (Aquifoliaceae) – Japanese holly

Cuyahoga Co.: Vermillion, on edge of river, Sep 2006, *A. Aerni 56* (MU). **Summit Co.**: along trail in upland woods, Munroe Falls Metropark, 28 May 1998, *A.W. Cusick 34399 & R.L. Gardner* (MU).

This species was listed by Wilder and McCombs (2002) for Cuyahoga County. These collections appear to be the only other Ohio records for this commonly cultivated holly.

IMPATIENS WALLERIANA Hook.f. (Balsaminaceae) – Impatiens, Busy Lizzy

Butler Co.: Oxford, Miami University campus, weedy along N wall of Gaskill Hall, and among bricks in patio, 21 Dec 2001, *M.A. Vincent 10449* (MICH, MO, MU, OS, OSH); *ibid*, 30 Jun 2005, *M.A. Vincent 12556* (MU); Miami University campus, NW corner of Shriver Center, weedy in sidewalk cracks, 19 Oct 2005, *M.A. Vincent 12632* (MU).

This species of *Impatiens* is very commonly cultivated as an annual bedding plant; it is native to eastern Africa, and, like other species of the genus, has explosively dehiscent capsules. It has previously been encountered as an escape in the USA only in Florida (USDA NRCS 2011), though Weakley (2011) also reports escaped in North Carolina and northern Georgia.

JUNIPERUS SABINA L. (Cupressaceae) – savin juniper

Franklin Co.: Hamilton Twp., large escaped, prostrate individual (up to two-feet tall & covering over 100 sq. ft. area) growing on dry, disturbed, N-facing embankment on S side of I-270, 100 ft. E of Groveport Rd. overpass & ¼ mi. W of Exit 49, Obetz, 11 Dec 2010, *B.P. Riley 1772-1774* (OS); *ibid, B.P. Riley 1775* (MU).

Juniperus sabina is not listed as part of the flora of North America by Adams (1993), though it is included on the USDA Plants website for Ontario (USDA NCRS 2011). It is an occasionally cultivated species, but Dirr (1998) describes it as not having a great deal to offer as an ornamental.

KALOPANAX SEPTEMLOBUS (Thunb.) Koidz. (Araliaceae) – castor aralia

INDIANA: Tippecanoe Co.: Stewart Woods, W of Purdue University campus, 10 Sep 2011, *N. Harby s.n.* (MU). **OHIO: Licking Co.**: Licking Twp., SW ¼ NE ¼ sect. 4, few locally scattered mature escaped shrubs growing in understory near extreme SE corner of mature mesic beech-maple woods recently acquired by the Dawes Arboretum, N side of Hupp Rd. (TR 309), 0.325 mi. E of SR 13, Newark, 9 Aug 2010, *D.M. Brandenburg 3395 & B.P. Riley* (DAWES).

Castor aralia is an occasionally cultivated spiny shrub native to eastern Asia (Dirr 1998). It has been reported as an escape for two states (USDA NRCS 2011), though unofficial reports are known for several others in the Midwest. It was just recently also discovered in Indiana as an escape, and is reported here as new to that state as well.

KOELREUTERIA PANICULATA Laxm. (Sapindaceae) – golden rain tree

Butler Co.: Oxford, Miami University campus, weedy near duck pond, 5 Sep 2008, *M.A. Vincent 14126* (MO, MU). **Preble Co.**: Camden, cleared hillside behind houses, 9 Oct 2005, *N. Howell 39* (MU). **Ross Co.**: along stream flood plain and weedy bank along river, Blair Rd. off Rt. 50, 10 Jun 2010, *M.A. & M.W. Vincent 14715* (MO, MU, NY, SRP); *ibid,* N central Paxton Twp., Morgantown Quad. Numerous mature local escapes located along E & W fencerow (particularly abundant on E side of main entrance) of Seip Mound State Memorial, S side of US Rt. 50, 1.35 mi. W-SW of California Hollow Rd. (T-150), 7 Sep 2008, *B.P. Riley 935* (OS).

Golden rain tree was first reported for Ohio by Cooperrider (1995) as an escape in Portage County and subsequently by Wilder and McCombs (2002) from Cuyahoga County. With three additional reports provided here, it is evident that this species is becoming more common as an escape and is naturalizing at least the Ross County site. It is relatively frequently found in many areas of the eastern half of the USA.

KYLLINGA GRACILLIMA Miq. (Cyperaceae) – Asiatic greenhead sedge, pasture spikesedge

Brown Co.: extreme S Union Twp., locally common species growing near soccer field in low/wet swale behind Ripley High School, 1317 S. 2nd St. (US Rt. 52), Ripley, 22 Aug 2009, *B.P. Riley 1369* (OS); *ibid,* 27 Sep 2009, *B.P. Riley 1370* (OS); *ibid, B.P. Riley 1371* (MU); *ibid, B.P. Riley 1372* (MICH). **Jackson Co.**: Liberty Twp., local, roadside spring fed ditch, 28 Aug 2011, *R.L. Gardner 7149 & D. Minney* (MICH, MU, OS).

Kyllinga gracillima is an introduced species from Asia which is found throughout most of the states in the eastern USA. It is found most frequently in wet areas such as along streams (Tucker 2002).

LAGERSTROEMIA INDICA L. (Lythraceae) – Crape myrtle

Butler Co.: Oxford, Miami University campus, weedy in flower beds, Hughes Hall, 13 Sep 2007, *M.A. Vincent 13768* (MU); *ibid,* 22 Sep 2010, *M.A. Vincent 15233* (MU, NY).

Crape myrtle is very widely cultivated as an ornamental shrub for its brightly colored flowers and attractive bark (Dirr 1998). It is known as an escape in much of the southeastern quarter of the USA (USDA NRCS 2011). With the introduction of more cold-hardy cultivars, it may be found more frequently in the northern half of the USA.

MALUS BACCATA (L.) Borkh. (Rosaceae) – Siberian crabapple

Belmont Co.: Weedy slope above mall parking lot below Interstate 70, E of Clairsville, 8 Aug 2010, *M.A. & M.W. Vincent 15193* (BKL, GH, MU, NY). **Wyandot Co.**: Salem Twp., S ½ SE ¼ SE ¼ sect. 11, locally common escaped species in canopy openings at N end of oak woods located on N side of CR 44, ¼ mi. E of US Rt. 23, Upper Sandusky, 9 Aug 2009, *B.P. Riley 1243* (OS).

Crabapples are notoriously difficult to identify, especially since many modern cultivars are of hybrid origin (Dirr 1998). Escaped specimens, which are often back-crosses or result from cross-cultivar hybridization, may prove exceedingly trying. It is possible, for many specimens, to at least approximate an identification using manuals and monographs which are available. The species given here match relatively well the species name given and are thus included.

Siberian crabapple is a very commonly cultivated species, of which several cultivars exist. It is included by Cooperrider et al. (2001) as part of the Ohio flora. This collection is included here to emphasize how commonly crabapples are escaping. They are undoubtedly much more widespread than current collections indicate.

MALUS PRUNIFOLIA (Willd.) Borkh. (Rosaceae) – Plumleaf crabapple

Belmont Co.: weedy slope above mall parking lot below Interstate 70, E of Clairsville, 8 Aug 2010, *M.A. & M.W. Vincent 15194* (MO, MU, NY). **Medina Co.**: weeds around abandoned restaurant, along Rt. 18 just off Interstate 71, 28 Jul 2010, *M.A. & M.W. Vincent 15018* (MU, NY). **Morrow Co.**: edge of gravel parking area along Rt. 95, just off Interstate 71, 28 Jul 2010, *M.A. & M.W. Vincent 15005* (MO, MU, NY).

Several cultivars of this crabapple species are relatively common as ornamentals (Dirr 1998). It is known from several states as an escape (USDA NRCS 2011), including Pennsylvania (Rhoads & Block 2000).

MALUS × *ROBUSTA* (Carriere) Rehder (Rosaceae) – Siberian crabapple

Muskingum Co.: weedy woods by Red Lobster Restaurant, OH Rt. 660 at OH Rt. 60/146, Zanesville, 8 Aug 2010, *M.A. & M.W. Vincent 15197* (BKL, MU, NY).

No records exist of this hybrid [*M. baccata* × *M. prunifolia*] as an escape in the U.S., though this specimen fits the descriptions well. Again, it is commonly cultivated, with several cultivars (Dirr 1998), and both parent species are also in cultivation, so it may be found more regularly as an escape.

MEDICAGO MINIMA (L.) L. (Fabaceae) – Little bur-clover

Hamilton Co.: fencerow, county fairgrounds, E of Springfield Pike, Wyoming, 30 Apr 1998, *A.W. Cusick 34282* (MU).

A relatively widespread weedy species, *M. minima* is reported for the northeastern U.S. (Gleason & Cronquist 1991), though it is more common further south and west.

METASEQUOIA GLYPTOSTROBOIDES Hu & W.C. Cheng (Cupressaceae) – Dawn redwood

Butler Co.: Oxford, saplings along E side of Formal gardens greenhouse, 4 Oct 2005, *M.A. Vincent 12626* (MU).

Dawn redwood, like *Ginkgo*, is widespread in the fossil record in North America and Asia, and was considered extinct until the late 1940's, when it was rediscovered living in China (Ma & Shao 2003). No other reports of the species as an escape in North America can be found, and it is only mentioned as possibly persisting after cultivation by Watson and Eckenwalder (1993).

PENNISETUM ALOPECUROIDES (L.) Spreng. (Poaceae) – Chinese fountaingrass

Adams Co.: Jefferson Twp., 1 plant in infrequently mowed lawn, stream bottom in Moon Hollow, *R.L. Gardner 6641 & R. McCarty* (OS). **Butler Co.**: Oxford Twp., weed in garden, 6 Oct 2010, *D. Powell 26* (MU). **Hocking Co.**: Good Hope Twp., NW ¼ SW ¼ NW ¼ sect. 23, locally escaped species growing along edge of occasionally wet ditch on S side of road in front of 26067 Buena Vista Rd. (CR 34), 0.40 mi. W of US Rt. 33, Rockbridge, 10 Oct 2010, *B.P. Riley 1644* (OS); *ibid*, *B.P. Riley 1645* (BHO).

Chinese fountain grass is frequently cultivated for its attractive plumose inflorescences (Wipff 2003). The species has been reported as an escape in at least four other states (USDA NRCS 2011), including Pennsylvania (Rhoads & Block 2000).

PHYLLANTHUS TENELLUS Roxb. (Euphorbiaceae) – Mascarene Island leaf-flower

Butler Co.: Oxford, weed in vegetable garden, 1 Oct 1994, *M.A. Vincent* 6861 (MU); Oxford, Miami University campus, weedy in "palm garden," Upham Hall courtyard, 19 Sep 2003, *M.A. Vincent 11421* (MU); *ibid*, 15 Oct 2004, *M.A. Vincent* 12321 (MO, MU, OS); *ibid*, around Upham Hall greenhouse, 2 Sep 2010, *M.A. Vincent 15216* (MO, MU, NY).

Phyllanthus tenellus is likely under-reported and more common than now known. The genus tends to be overlooked, and species are difficult to identify. This species is a common weed in greenhouses and found among bedding plants available through "big-box" stores and other outlets. The populations on the Miami University campus are robust and spreading. It is widely distributed as a weed throughout the southeastern USA (USDA NRCS 2011).

PINUS TAEDA L. (Pinaceae) – loblolly pine

Meigs Co.: Olive Twp., numerous scattered, escaped saplings along N side of Number Nine Rd. (T-265) at Lake Rd. (T-277) int., Shade River State Forest, 4 Aug 2006, *B.P. Riley 467* (OS). **Vinton Co.**: Madison Twp., SE ¼ sect. 34, numerous escaped saplings along N edge of F. Rd. 1 within Will Tract (planted 1940), .25 mi. W of SR 278, Zaleski State Forest, 23 Jul 2006, *B.P. Riley 468* (OS).

Loblolly pine is native to the southeastern USA (Kral 1993), and is sometimes used in pine plantations for pulpwood and lumber. It has spread beyond its native range as escapes from cultivation as far north as Illinois and Kentucky (USDA NRCS 2011).

PRUNELLA LACINIATA (L.) L. (Lamiaceae) – Cutleaf selfheal

Clinton Co.: Cowan Lake State Park, grassy berm near commissary, 26 Jun 2004, *M.A. Vincent 12126* (MICH, MO, MU, OS).

Wilder and McCombs (2002) report *P. laciniata* as new to Cuyahoga County, Ohio. This is the second record from the state, and was likely introduced with grass seed. It is known from scattered populations in the eastern USA (Gleason & Cronquist 1991; USDA NRCS 2011).

PRUNUS ARMENIACA L. (Rosaceae) – apricot

Hardin Co.: Jackson Twp., E ½ NE ¼ sect. 25, small clonal thicket of individuals up to 6' tall located across from 4220 SR 53 on W side of road & on E side of abandoned RR, ¼ mi. S of TR

50, 26 Jun 2007, *B.P. Riley 706* (OS). **Wood Co.**: Henry Twp., NE ¼ NE ¼ sect. 24, one mature escaped individual ca. 13 ft. tall located along brushy fencerow on W side of Insley Rd., ca. 200' S of Oil Center Rd., 30 Aug 2006, *B.P. Riley 474* (OS).

Although apricots are relatively widely cultivated as fruit trees, records of escapes are uncommon (Gleason & Cronquist 1991).

PRUNUS PADUS L. (Rosaceae) – European bird cherry

Butler Co.: Oxford, weedy in hedgerow, Erin Dr. near Glos Dr., 3 Jun 2010, *M.A. & M.W. Vincent 14685* (MO, MU, NY). **Darke Co.**: Shawnee Prairie Preserve OH Rt. 502, just W of Greenville, 6 Jun 2003, *M.A. Vincent et al. 11069* (MU).

Prunus padus is native to Eurasia, and has long been cultivated for its attractive flowers, foliage, and bark (Dirr 1998). Even so, reports of the species as escapes are rare. Rhoads & Block (2000) report the species for Pennsylvania.

QUERCUS PHELLOS L. (Fagaceae) – willow oak

Clermont Co.: extreme ESE Miami Twp., two escaped saplings (up to 2.5 feet tall) growing in understory of young, soft maple woods on small hummocks within wet, acidic site near E edge of power line clearing (acidic meadow) on W side of Miami Meadows Park, 1546 SR 131, Milford, 18 Aug 2010, *B.P. Riley 1675, D. Boone & R. Cranfill* (OS).

The native range for willow oak is the southeastern states, north into southwestern Kentucky and southeastern Missouri (Jensen 1997; Stein et al. 2003). It is occasionally cultivated in Ohio, at least in the southern half of the state, and has been rarely seen to escape. This collection appears to be the first documentation of the species outside cultivation in Ohio.

QUERCUS ×DEAMII Trelease (*Quercus macrocarpa* × *Q. muehlenbergii*) (Fagaceae) – Deam's oak

Hamilton Co.: Cincinnati, one mature, native hybrid (49.50" DBH x 82' tall) located on W edge of section 9 on SW side of Spring Grove Cemetery & Arboretum, 4521 Spring Grove Ave., 31 May 2004, *B.P. Riley 575.01-575.06* (OS). **Hancock Co.**: Liberty Twp., NW ¼ NW ¼ NW ¼ sect. 26, one young, native individual with 4.90" DBH × ca. 25' tall (as of 8/25/2006) located along E edge of hiking trail in young woods, just W of Discovery Center within Oakwoods Nature Preserve on W side of CR 144, .80 mile S of CR 88, Findlay, 25 Aug 2006, *B.P. Riley 575.07-575.10* (OS); *ibid,* 28 Aug 2006, *B.P. Riley 575.11* (OS).

QUERCUS ×EGGLESTONII Trelease (*Quercus imbricaria* × *Q. shumardii*) (Fagaceae) – Eggleston's oak

Adams Co.: eastern Brush Creek Twp., one medium-size tree (12.01" DBH × ca. 50' tall as of date collected) located in mesic woods near drainage on S side of Easter Run & on N side of trail to Buzzardroost Rock on S side of State Route 125 within Edge of Appalachia Preserve, 2 Jul 2005, *B.P. Riley 576.01* (OS).

QUERCUS ×*GUADALUPENSIS* Sargent (*Quercus macrocarpa* × *Q. stellata)* (Fagaceae) – (bur oak × post oak)

Madison Co.: NE Canaan Twp., one mature, native tree (26.50" DBH × 56' tall as of 3/21/2005) located on N side of parking lot at Big Darby Baptist Church, 6921 Plain City Georgesville Road, along E edge of road in grassy area W-SW of basketball court; ca. 400' N of Price Hilliard Rd. & Plain City-Georgesville Rd. intersection & 4.50 miles N of I-70, Plain City, 21 Sep 2005, *B.P. Riley 579.04* (OS).

QUERCUS ×*PALMERIANA* A. Camus (*Quercus imbricaria* × *Q. falcata*) (Fagaceae) – Palmer's oak

Scioto Co.: Bloom Twp., E central ½ sect. 29, one large individual (29.4" DBH × 73' tall as of 5/9/2003) located at fork in road/intersection of Bloom Furnace Rd. (CR 291) & Brushy Fork Rd. (T-292), 2.7 miles SE of State Route 140, South Webster, (tree was cut down as of 13 Oct 2006), 9 May 2003, *B.P. Riley 584.01* (OS); *ibid,* 21 Jul 2005, *B.P. Riley 584.02-584.03* (OS); *ibid,* 13 Oct 2006, *B.P. Riley 584.04-584.05, B. Weber & R. Larson* (OS).

QUERCUS ×*RIPARIA* Laughlin (*Quercus rubra* × *Q. shumardii*) (Fagaceae) - (northern red oak × Shumard oak)

Shelby Co.: Clinton Twp., NE ¼ sect. 1, one large, native tree (50.04" DBH × ca. 75' tall as of date collected) with metal inventory tag number 72, located at NE corner of section 4 within Graceland Cemetery, CR 25-A (South Main Street), S end of Sidney, 30 Jun 2005, *B.P. Riley 585.01-585.04* (OS).

QUERCUS ×*VAGA* Palmer & Steyermark (*Quercus palustris* × *Q. velutina*) (Fagaceae) – unfixed oak

Lucas Co.: Swanton Twp., S central ½ N central ½ sect. 20, one mature, native tree (20.75" DBH × ca. 65' tall as of date collected) growing in open oak savanna at Girdham Road Sand Dunes on E side of Girdham Rd., ca. ¼ mile S of Monclova Rd., just S of paved bike trail & E of 25 MPH/Bike sign, Oak Openings Metro Park, 25 Aug 2004, *B.P. Riley 590.01* (OS).

QUERCUS ×*WILLDENOWIANA* (Dippel) Zabel (*Quercus falcata* × *Q. velutina*) (Fagaceae) – Willdenow's oak

Jackson Co.: Jefferson Twp., S ½ NE ¼ sect. 35, one mature double-stemmed tree (largest stem measures 16.90" DBH × ca. 45' tall as of date collected) hanging over road, ca. 16 feet off E edge of CR 65/dry upland woods, on N-facing mid slope, near Bethel Church & Cemetery, Blackfork Station, 4 Aug 2007, *B.P. Riley 591.07* (OS). **Scioto Co.**: Harrison Twp., NE ¼ NE ¼ SE ¼ sect. 3, one mature tree (14.77" DBH × ca. 45' tall as of 2/2/2005) located on W-SW side of Kendall Rd. (T-230 – ca. 15' off road) just S of gravel driveway at 198 Kendall Rd., .60 mile N-NW of Taylor Hill Rd. (T-235), Minford, 2 February 2005, *B.P. Riley 591.02-591.03* (OS); *ibid,* 13 Oct 2006, *B.P. Riley 591.04, B. Weber & R. Larson* (OS); *ibid,* 10 Oct 2005, *B.P. Riley 591.05* (OS).

RUBUS OCCIDENTALIS L. var. *PALLIDUS* L.H. Bailey (Roseaceae) – black raspberry

Clinton Co.: Cowan Lake State Park, off Yankee Rd., 23 Jun 2005, *M.A. & M.W. Vincent 12541* (MU). **Hocking Co.**: Good Hope Twp., SW ¼ NE ¼ sect. 20, large population located in Conservation Area, .4 mile SW of Clear Creek Rd. (CR 116) on SW side of Starner Rd. (T-117), Clear Creek Metro Park, 28 Aug 2005, *B.P. Riley 302* (OS). **Pickaway Co.**: Walnut Twp., SE ¼

sect. 30, small native population located along Butterfly Trail at Stages Pond SNP, 4792 Hagerty Rd., 1.65 mi. E of US Rt. 23, 18 December 2005, *B.P. Riley 303* (OS).

This is a yellow-fruited variety of the common raspberry, as mentioned in Fernald (1950).

RUBUS PARVIFOLIUS L. (Roseaceae) – Japanese/trailing raspberry

Highland Co.: Extreme northern Paint Twp., small, escaped population growing on N edge of entrance to gravel parking lot on E side of SR 138, ca. 40 ft. off E edge of SR 138 & ca. 200 ft. N-NE of Cope Rd. (CR 85), Paint Creek Wildlife Area, 3 Jul 2010, *B.P. Riley 1691-1692* (OS); *ibid, B.P. Riley 1693-1694* (MU). **Knox Co.**: Liberty Twp., sect. 4-10, large extensive, escaped population growing within overhead power line clearing along W edge of Fairview Rd. (CR 50), .20 mi. N of US Rt. 36, Mt. Vernon, 28 Oct 2010, *B.P. Riley 1695-1696* (OS). **Muskingum Co.**: Washington Twp., NW ¼ SE ¼ sect. 3, locally abundant, escaped population growing throughout eastern white pine plantation on S end of former Zanesville State Nursery, 5880 Memory Rd., Zanesville, 26 Jun 2009, *B.P. Riley 1290-1291* (OS); *tbid, B.P. Riley 1292 & B L. Weber* (MU); *tbid,* 25 Jul 2009, *B.P. Riley 1296* (MICH). **Pickaway Co.**: Pickaway Twp., S central ½ S ½ sect. 12, large escaped population growing along wooded edge on N side of drainage in small open area on E side of US Rt. 23 & W side of T-513, .10 mi. N of SR 361, 15 Jun 2007, *B.P. Riley 768-769* (OS); *ibid,* 26 Jun 2009, *B.P. Riley 1293-1294* (MICH); *ibid, B.P. Riley 1295* (MU); *ibid,* 25 Jul 2009, *B.P. Riley 1297* (OS); Pickaway Twp., W ½ SE ¼ SW ¼ sect. 19, large escaped (not planted) invasive population along split rail fence along N-NW edge of Logan Elm State Memorial on SR 361 W, 1.0 mile E of US Rt. 23, 13 Jul 2008, *B.P. Riley 1022* (OS).

Rubus parvifolius, native to Australia, China and Japan, is a low arching shrub with pink or purple petals and a red, edible fruit (Rehder 1940). Though not listed among *Rubus* species on the USDA Plants web site (USDA NRCS 2011), it is a rapidly spreading invasive species now known from at least five states (Drobney & Widrlechner 2010).

SACCHARUM RAVENNAE (L.) L. – Plume grass

Greene Co.: Bath Twp., extreme NE. ¼ sect. 28, Wright-Patterson Air Force Base, Sand Hill, just S. of Clark/Greene County line, occasional in dry, limestone field, 7 Sep 2010, *R.L. Gardner 6987, M. Becus & J. Helton* (OS). **Hocking Co.**: Hill Twp., S. of exit, on road cut, E. of north bound U.S. Rt. 33, rare, a few plants, 18 Sep 2008, *R.L. Gardner 6061* (OS). **Ross Co.**: City of Chillicothe, roadside of southbound U.S. Rt. 23 at U.S. 50 exit, 28 Sep 2010, *R.L. Gardner 6998* (OS).

This popular ornamental grass was first reported for Ohio by Wilder and McCombs (2002) for Cuyahoga County. It occurs on roadside lawns and steep, grassy roadbanks around the city of Columbus in Franklin County. It appears to be increasing numbers in the city in the last 5 years. Plume grass also occurs along highways in Delaware, Hamilton, Scioto, and Wayne counties.

SALIX MATSUDANA Koidzumi (Salicaceae) – corkscrew willow

Adams Co.: extreme S central Green Twp., two escaped individuals up to four ft. tall growing in sandbar along E edge of West Fork Ck. on S side of access lane leading up to Point Cemetery, ca. 160 ft. W of Blue Creek Rd. (C-18), .30 mi. N of US Rt. 52, Rome, 6 Sep 2008, *B.P. Riley 1046* (OS).

Salix matsudana is native to northeastern Asia, and many cultivars exist (Dirr 1998). The species was reported for Ohio by Cooperrider et al. (2001), but is rarely found as an escape. It is only known from six states in the USA (USDA NRCS 2011).

SCHOENOPLECTUS MUCRONATUS (L.) Palla (Cyperaceae) – rough-seed bulrush

Butler Co.: Ross Twp., ODOT wetland mitigation site S of Hamilton-New London Rd., E of US Rt. 27, 15 Jun 2006, *M.A. Vincent 12858, V. Baird & K. Levings* (MU); *ibid*, 12 Aug 2008, *B. Wilfong 2* (MU). **Fairfield Co.**: Violet Twp., sect. 22, scattered, 51-100 plants in created wetland, 16 Aug 2008, *R.L. Gardner 5997, K. Asnani, D. Hague & T. Hague* (MU, OS). **Hamilton Co.**: Miami Whitewater Forest, colony of 100 or more plants growing in the wetland near rose mallow, 16 Jul 2005, *Becus 71605C & D. Conover* (MU, OS). **Pickaway Co.**: Madison Twp., mitigation wetland, Slate Run Metro Park, 15 Sep 2005, *R. Sanders s.n.* (MU).

Schoenoplectus mucronatus, a Eurasian native (Smith 2002b), is spreading quickly in North America. Its quick spread has been aided by it being part of wetland seed mixes for mitigation wetlands. Wetland plant suppliers have mistaken this species for the native *S. pungens*. According to the landowners of the Butler County and Fairfield County sites, no seed mixes were used to develop the wetland.

SENNA OBTUSIFOLIA (L.) Irwin & Barneby (Fabaceae) – Java-bean

Butler Co.: Oxford Twp., sect. 34, Booth Rd., weed in flower bed, 26 Sep 2009, *M.A. & M.W. Vincent 14565* (MICH, MU, NY).

Java-bean is a native species of the New World tropics that is now widely distributed in the eastern half of the USA, up until now found in most eastern states except Ohio (Isely1998; USDA NRCS 2011).

SMILAX BONA-NOX L. (Smilacaceae) – saw greenbrier

Butler Co.: Oxford, Miami University campus, weedy in "palm garden", Upham Hall courtyard, 19 Sep 2003, *M.A. Vincent 13232* (MU).

First seen at this site in 2002, saw greenbrier persisted here through 2008. The plants were apparently introduced with perennials purchased in the Carolinas for planting here, and died back to the ground each winter, coming up anew each spring. While Cooperrider et al. (2001) list *S. bona-nox* among their deleted species, Holmes (2002) includes Ohio in the range for the species.

SORGHUM* × *ALMUM Parodi (Poaceae) – Columbus grass

Butler Co.: Milford Twp., edge of farm field along St. Rt. 73, 22 Sep 2010, *M.A. & M.W. Vincent 15235* (MU, NY).

This hybrid derivative of *S. halepense* (L.) Pers. (Johnson grass) and *S. bicolor* (L.) Moench (sorghum) is occasionally encountered where the two species have occurred in proximity. It has wider spikelets and more veiny glumes than *S. halepense* (Barkworth 2003b). This hybrid has also been observed in Darke County as a field weed.

SPIRAEA JAPONICA L.f. (Rosaceae) – Japanese Spiraea

Adams Co.: Meigs Twp., SW. of jct. of Davis Memorial & Beaver Pond Rds., rare at edge of prairie opening, 27 Jul 2007, *R.L. Gardner 3463* (OS); Green Twp., head of Southdown Fork, occasional, escaped from original planting at abandoned home site, 22 Jun 2010, *R.L. Gardner 6853 & R. McCarty* (OS). **Athens Co.**: Dover Twp., sect. 33, Utah Ridge, 1 July 2008 *R.L. Gardner 5919* (OS). **Licking Co.**: Fallsbury Twp., NE ¼ NE ¼ sect. 8, locally common escaped shrub growing throughout understory of mature red and eastern white pine plantation located at 12122 Pine Bluff Rd. 12 Jul 2010, *B.R. Riley 1708* (OS). **Ross Co.**: Colerain Twp., S. of Pleasant Hill Church, W. of St. Rt. 327, rare in mature woods, 20 Jun 2007, *R.L. Gardner 5671* (OS). **Scioto Co.**: Union Twp., Colley Rd. N. of McDermott, frequent in pasture, 27 Jun 2006, *R.L. Gardner 5263* (OS); Clay Twp., SE ¼ NW ¼ SW ¼ sect. 14, locally escaped population consisting of several shrubs growing in small canopy opening within dry-xeric, ridgetop oak-pine woods behind/on N-NW side of Long Run Universal Cemetery, 28 Aug 2010 *B.R. Riley 1709* (OS), *1710* (MU). **Washington Co.**: Independence Twp., sect. 13, locally common to scattered; spreading along Davis Run, 8 Jul 2008 *R.L. Gardner 5931* (OS); Lawrence Twp., St. Rt. 26 near Moss Run, rare, edge of stream, 7 Jul 2008, *R.L. Gardner 5953* (OS). **Wayne Co.**: Plain Twp., Wooster Memorial Park, occasional, spreading from introduction along old access lane, 7 Jul 2010, *R.L. Gardner 6875* (OS).

Though previously reported for Ohio (Cooperrider et al. 2001; Furlow 1991 [Tuscarawas Co.]), these records of Japanese spiraea show that it appears to be spreading quickly in southern Ohio, with rare local escapes in the northern part of the state. This species is a serious pest in southeastern USA, invading a variety of habitats (Anonymous 2005).

SYMPLOCOS PANICULATA (Thunb.) Miq. (Symplocaceae) – sapphire-berry

Licking Co.: Licking Twp., SW ¼ NE ¼ sect. 4, few locally scattered mature escaped shrubs growing in understory near extreme SE corner of mature mesic beech-maple woods recently acquired by the Dawes Arboretum, N side of Hupp Rd. (TR 309), .325 mi. E of SR 13, Newark, 9 Aug 2010, *B.P. Riley 1715-1716 & D.M. Brandenburg* (OS); *ibid*, *D.M. Brandenburg 3396-3397 & B.P. Riley* (DAWES).

Sapphire-berry is an occasionally cultivated Asian shrub or small tree with attractive foliage and white flowers, grown especially for its visually appealing blue fruits (Dirr 1998; Rehder 1940). It was previously reported as an escape in the USA only from Pennsylvania (Rhoads & Block 2000), though a specimen of the species as an escape in D.C. (*A.T. Whittemore 00-015*) is housed at MU.

TSUGA CAROLINIANA Engelm. (Pinaceae) – Carolina hemlock

Summit Co.: Boston Twp., several naturalized saplings growing on & along W-facing sandstone rock ledges S-SE of Octagon Parking Area w/in Kendall Park on N side of Truxell Rd., 1.95 mi. E of Akron-Peninsula Rd., Cuyahoga Valley Nature Preserve, 27 Aug 2006, *B.P. Riley 22* (OS).

ULMUS PARVIFOLIA Jacq. (Ulmaceae) – Chinese elm/lacebark elm

Butler Co.: Oxford, Miami University campus, hundreds of seedlings/saplings weedy around Pearson Hall, 9 Sep 2011, *M.A. Vincent 15665* (MU, NA, NY). **Franklin Co.**: Madison Twp., E ½ E ½ NW ¼ sect. 4, extremely abundant local escapes (numerous saplings of various sizes) growing in unmanaged area near mature, planted trees located at SE corner of Helsel Park, W side of

S. Hamilton Rd., ¼ mi. S of Refugee Rd., Columbus, 19 Oct 2010, *B.P. Riley 1732-1733* (OS). **Warren Co.**: Franklin, woods at end of Lance Dr., 19 Nov 2006, *S. Kennedy 34* (MU).

Chinese elm is likely more common as an escape than is indicated by Sherman-Broyles (1997), given the large numbers of seedlings and saplings often found near cultivated trees.

ULMUS PUMILA L. × *U. RUBRA* L.(Ulmaceae) – Siberian elm/slippery elm hybrid

Pickaway Co.: Harrison Twp., extreme N edge NE ¼ NE ¼ sect. 11, few escaped sapling individuals (up to 12' tall) growing along fencerow on N edge of soccer fields at Teays Valley Park on N side of SR 752, 1.15 mi. E of US Rt. 23, Ashville, 19 Sep 2009, *B.P. Riley 1367* (OS). **Union Co.**: Jerome Twp., one mature tree growing along W-SW edge of small woods along E-NE edge of RR tracks, .20 mi. S-SE of Converse Rd. (CR 23) at Currier Rd. (TR 8) int., Plain City, 1 Oct 2010, *B.P. Riley 1740-1741* (OS). **Wood Co.**: Henry Twp., S central ½ S ½ SE ¼ sect. 1, small, localized, escaped population (3-4 individuals up to 25' tall) growing with several *Ulmus pumila* saplings on dry, disturbed site on E side of propane facility, located on Cygnet Rd. at NW corner of SR 25 near I-75 exit 171, Cygnet, 10 Sep 2008, *B.P. Riley 1077* (OS).

This hybrid elm is a widespread derivative of the introduced Siberian elm and the native slippery elm (Sherman-Broyles et al. 1997). On the USDA Plants web site (USDA NRCS 2011), it is called "*Ulmus* × *notha* Wilhelm & G. Ware, ined.", and its presence in three states is indicated.

VIBURNUM CARLESII Hemsl. (Caprifoliaceae) – Koreanspice viburnum

Butler Co.: Oxford, Miami University campus, Bishop Woods, common understory plants, 22 Apr 2003, *M.A. Vincent 10978* (MICH, MO, MU, NA, OS, OSH). **Hamilton Co.**: Green Twp., Cincinnati, Hutchinson Rd., in field close to forest, 12 Sep 2001, *J.M. Zeek 27* (MU).

Not previously reported as an escape in North America, Koreanspice viburnum is widely planted for its clusters of attractive and fragrant flowers (Dirr 1998; Rehder 1940). This species is likely more widespread, given the frequency with which it is planted.

VIBURNUM PRUNIFOLIUM L. × *V. RUFIDULUM* Raf. (Caprifoliaceae) – (blackhaw viburnum × rusty viburnum)

Adams Co.: SE ¼ Tiffin Twp., one hybrid individual growing amongst typical blackhaw viburnum along edge of Soldier's Run on S side of SR 125 on conservation easement property next to The Edge of Appalachia Preserve & managed by TNC, 25 Jun 2005, *B.P. Riley 172 & R. Gardner* (OS); SE Franklin Twp., one mature hybrid individual located on S side of Portsmouth Rd. (CR 198) along wooded edge under power lines, 1.25 mi. E-SE of US Rt. 32, 1 Jul 2006, *B.P. Riley 541* (OS).

VIBURNUM SETIGERUM Hance (Caprifoliaceae) – Tea viburnum

Hamilton Co.: spontaneous at woodland margin, Spring Grove Cemetery, Cincinnati, 18 Oct 2003, *M.K. Whitson & J.W. Thieret 61732* (MU, KNK).

A Chinese species, *V. setigerum* is characterized by its long, acuminate leaves with widely spaced teethe, and its red to orange fruits (Dirr 1998; Rehder 1940). It has previously been reported as an escape in Pennsylvania, New York and Connecticut (USDA NRCS 2011).

VIBURNUM SIEBOLDII Miq. (Caprifoliaceae) – Siebold's arrowwood

Butler Co.: Oxford, Miami University campus, woods next to Flower Hall, 16 Jul 1997, *K.M. Shockey 139* (MU). **Licking Co.**: Licking Twp., N ½ NE ¼ SE ¼ sect. 4, one mature, escaped shrub growing in canopy opening within mature mesic beech-maple woods off N edge of Gorge Trial within East Woods Arboretum, W of Quarry Run & .84 mi. E of SR 13, The Dawes Arboretum, 22 Jul 2010, *B.P. Riley 1752-1753* (OS); *ibid, B.P. Riley 1754 & D.M. Brandenburg* (MU). **Summit Co.**: edge of beech-maple woods, Goodyear Heights Metropark, N of Newton St., Akron, 28 May 1998, *A.W. Cusick 34404 & R. Gardner* (MU).

Siebold's arrowwood is known from several states in the mid-Atlantic region of the USA, including Pennsylvania (Rhoads & Block 2000; USDA NRCS 2011).

YOUNGIA JAPONICA (L.) DC. (Asteraceae) – Oriental false hawksbeard

Butler Co.: Oxford, Miami University campus, weedy in "palm garden", Upham Hall courtyard, 19 Sep 2003, *M.A. Vincent 11420* (MU).

This Asian species is found throughout much of the southeastern USA, as far north as Pennsylvania and New York (Spurr 2006). This population was first seen in 2002 and persisted until 2006.

ZOYSIA JAPONICA Steud. (Poaceae) - Korean lawngrass

Franklin Co.: Madison Twp., SW ¼ NE ¼ sect. 5, locally widespread naturalized and escaped species forming large clonal colony near brush line in far backyard, 3003 Courtright Rd., Columbus, 22 May 2011, *B.P. Riley 1777* (OS).

Anderson (2003) described Korean lawngrass as the first species *Zoysia* introduced in North America. According to the USDA Plants database (USDA NRCS 2011), the species is known from 11 states, including Indiana and Kentucky.

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Turner, B.L. 2011. A new species of *Zeltnera* (Gentianaceae) from Tamaulipas, Mexico. Phytoneuron 2011-61: 1–3. Mailed 29 November 2011. ISSN 2153 733X

A NEW SPECIES OF *ZELTNERA* (GENTIANACEAE) FROM TAMAULIPAS, MEXICO

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ABSTRACT

A new taxon, **Zeltnera nesomii** B.L. Turner, sp. nov., is described from the Sierra de San Carlos in Tamaulipas, Mexico. It is seemingly most closely related to the *Z. calycosa* complex of northern Mexico and closely adjacent Texas but differs in numerous characters, including ecogeography, branching habit, and leaf, corolla, and anther size. A photograph of the holotype is provided, along with a map comparing the distribution of the two species.
KEY WORDS: Gentianaceae, *Zeltnera, Z. calycosa*, Mexico, Tamaulipas

In Mansion's (2004) phyletic dismemberment of the classically conceived *Centaurium*, the present novelty is positioned in the predominantly North American genus *Zeltnera*. In his account, because of its small anthers and corollas, *Z. nesomii* readily keys to or near *Z. quitensis* (Kunth) Mansion. But, as well noted by Broome (1976), the latter "is always easily recognized because of the small tetramerous flowers," a character not employed in Mansion's key to species.

Zeltnera nesomii apparently belongs to Mansion's "Texan group" of taxa, which includes 8 species, most of these treated by Turner (1993), albeit as part of *Centaurium*. Among these, *Z. nesomii* is seemingly most closely related to *Z. calycosa* (Buckl.) Mansion. The latter, however, has a larger, less intricately branched habit and larger floral parts and its geographic distribution and ecology are distinct from the new species. The distribution of *Z. calycosa* continues into Texas and New Mexico. The two species are readily distinguished as follows.

1. Larger cauline leaves 2–3 times as long as wide; corolla lobes 5–6 mm long, 2–3 mm wide; anthers, before anthesis, ca 1.5 mm long ..... **Zeltnera nesomii**
1. Larger cauline leaves 3–5 times as long as wide; corolla lobes 8–11 mm long, 3–5 mm wide; anthers ca 3 mm long before anthesis ..... **Zeltnera calycosa**

ZELTNERA NESOMII B.L. Turner, sp. nov. Figure 1. **TYPE: MEXICO. Tamaulipas**. Mpio. San Carlos: Sierra de San Carlos, ca. 5 mi S of San Carlos, N side of Bufa El Diente, igneous bedrock, N-facing steep slope, woods of scattered oaks and shrubby vegetation of *Rhus*, *Croton*, *Chiococca*, *Helietta*, *Vauquelinia*, rich herbaceous layer, 770 m, 24° 31.5' N, 98° 57.6' W, flowers pink-rose, scattered but common, 17 Jun 1987, *G. Nesom 6051* with J. Norris, M. Martinez, and L. Woodruff (holotype: TEX).

Zeltnerae calycosae (Buckl.) Mansion similis sed differt foliis proximalibus 2–3plo longiorius quam latioribus (vs 3–5plo), corollis minoribus (lobis 5–6 mm in longitudine 1–2 mm in latitudine vs 8–11 mm x 3–5 mm; tubis 8–9 mm in longitudine vs 10–12 mm), et antheris (preanthesis) minoribus (ca 1.5 mm in longitudine vs ca 3 mm).

Figure 1. *Zeltnera nesomii* (holotype: TEX).

Annual glabrous herbs 10–15 cm tall, much-branched from about the middle of the main stem, the lower stems 4-sided and possessing wings ca 0.25 mm wide. **Leaves** opposite below, elliptic to oblanceolate, mostly 1–2 cm long, 0.5–1.0 cm wide, the margins entire. **Inflorescence**, much-branched, terminal thryse ca 6–8 cm high, 6–8 cm wide. **Corollas** "pinkish-rose," the lobes 5–6 mm long, 1–2 mm wide, tubes 8–9 mm long. **Sepals** 5, linear-lanceolate, 6–8 mm long. **Anthers** ca 1 mm long before anthesis, afterwards ca 1.5 mm long. **Styles** ca as long as the stamens, broadly bilobed, their apices ca 0.25 mm wide. **Capsules** linear, 7–8 mm long, ca 1.5 mm wide. **Seeds** broadly ovate, ca 0.4 mm long, 0.3 mm wide.

Additional specimen examined. **MEXICO. Tamaulipas**. Same locality as the Type but "near top of slope, igneous bedrock, open woods of scattered oaks and pines, ca 1200 m, scattered but common," 18 Jun 1987, *Nesom 6140* (TEX).

The novelty is named for Guy Nesom, collector of the plant on a field trip with colleagues from the University of Texas Plant Resources Center in 1987.

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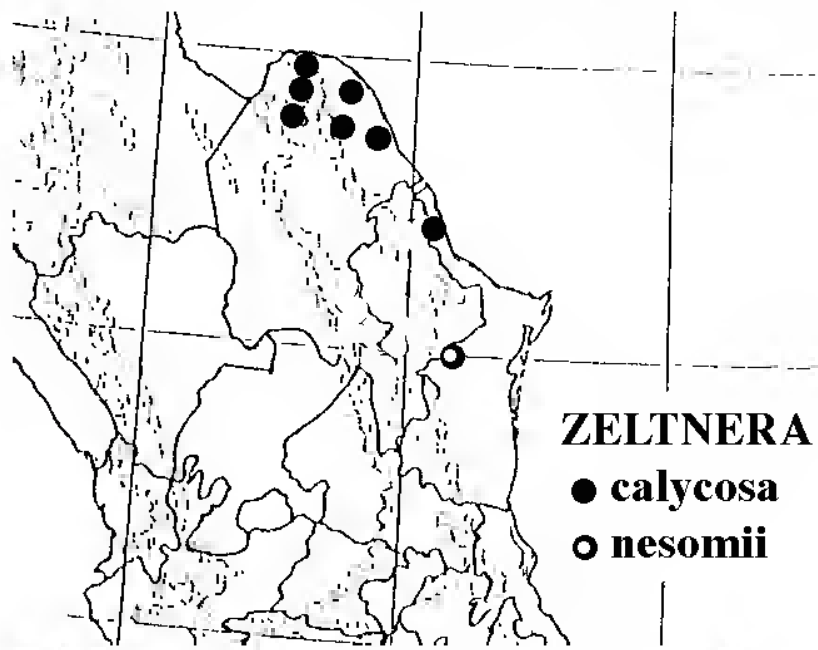

Figure 2. Distribution of *Zeltnera nesomii* and *Z. calycosa* in northern Mexico.

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A NEW PUTATIVE HYBRID IN *SILPHIUM* (ASTERACEAE: HELIANTHEAE)

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ABSTRACT

The occurrence of a novel putative hybrid from Jackson County, Missouri, is reported and discussed. This hybrid occurs spontaneously at an upland prairie restoration site and appears to represent the cross *Silphium integrifolium* × *S. laciniatum*. The morphological features of the presumed parents and putative hybrid are discussed and contrasted. The literature on hybridization in Midwestern *Silphium* is reviewed.

KEYWORDS: *Silphium*, Asteraceae, hybridization, Missouri flora

The genus *Silphium* L. comprises a dozen species of herbaceous perennial in the large angiosperm family Asteraceae (Clevinger 2006). It is endemic to the North American continent with all of the species occurring in the United States east of the Rocky Mountains and only a few ranging farther south or west. Most of the species are distinctive morphologically and, although the widespread taxa exhibit considerable variation and have sometimes been divided into varieties or subspecies, in general the species are relatively easily distinguished.

In Missouri, Yatskievych (2006) treated six species, which include such well-known wildflowers as compass plant (*Silphium laciniatum* L.), cup plant (*S. perfoliatum* L.), prairie dock (*S. terebinthinaceum* Jacq.), rosinweed (*S. integrifolium* Michx.), and starry rosinweed (*S. asteriscus* L.), and also the uncommon and likely non-native rough-leaved rosinweed (*S. radula* Nutt.). Reports of interspecific hybrids between these taxa have been few. Steyermark (1963) mentioned possible hybridization between *S. asteriscus* L. and *S. integrifolium*, based on rare plants keying to the latter species but with some of the leaves alternate. However, possible past introgression between these species has not been documented in the subsequent botanical literature, and the aberrant plants may represent merely morphological variation within *S. integrifolium*.

Yatskievych (2006) mentioned specimens collected in Bates and Warren counties that appear to represent the hybrid, *Silphium integrifolium* × *S. perfoliatum*. These plants have only the uppermost leaves somewhat perfoliate and the involucral bracts are intermediate in morphology between the putative parents. They are not morphologically equivalent to plants described earlier from Stone County as *S. perfoliatum* f. *petiolatum* E.J. Palmer & Steyerm. (1958). Cruden (1960) suggested that f. *petiolatum* represented late-season specimens with somewhat dwarfed morphology and did not think it necessary to formally recognize this morph taxonomically.

Steyermark (1963) mentioned the existence of hybrids between *Silphium laciniatum* and *S. terebinthinaceum* in other states, but had not seen any material collected in Missouri. Subsequently, Redfearn (1980) reported such hybrids from mixed populations of the parental taxa in Dallas and Stone Counties (as well as from northern Arkansas). This appears to be the most common, naturally occurring interspecific hybrid in the genus. It was studied by quantitative analysis of morphological

features by Fisher (1959, 1966), based on populations in Illinois, Indiana, and Ohio.

Later, Fisher and Speer (1978) presented cytological and morphological evidence that this hybrid is of more widespread occurrence in the southeastern United States and, in fact, had long ago received its own binomial, *Silphium pinnatifidum* Elliott. However, it should be noted that because her molecular studies (Clevinger 2000) had indicated a very close affinity between *S. pinnatifidum* and *S. terebinthinaceum*, Clevinger (2006) chose to treat this taxon as *S. terebinthinaceum* var. *pinnatifidum* (Elliott) A. Gray rather than as an interspecific hybrid. Thus, the relationship of plants described as *S. pinnatifidum* to those documented as hybrids between *S. laciniatum* and *S. terebinthinaceum* requires further study.

A new hybrid *Silphium*.

During recent botanical field work in Jackson County, the senior author discovered a single individual that appears to represent yet another putative hybrid *Silphium* in Missouri. The presumed parents of this hybrid are *S. integrifolium* var. *integrifolium* and *S. laciniatum*, which were the only two species in the genus occurring in the vicinity of the morphologically aberrant individual.

The site at which this find was made is Jerry Smith Park (formerly Jerry Smith Farm Park), a nature park on the south side of the Kansas City metropolitan area (38° 52' 57" N Lat., 94° 34' 04" W Long.), in Jackson county. It is owned by the Kansas City Parks and Recreation Department and managed with help from the Missouri Department of Conservation (which owns the small, adjacent Saeger Woods Conservation Area), Kansas City WildLands (a private group promoting biodiversity and plant community restoration in the metropolitan region), and other organizations. This 360-acre site came into public ownership in 1976. Management efforts since then have focused on restoration and expansion of the initially small persistent patches of natural upland tallgrass prairie. Today, more than a third of the property has prairie habitat in varying degrees of restoration.

Within Jerry Smith Park, a loop trail creates access to much of the property. At one point where this trail crosses the prairie, a spur leads westward to an observation platform. Near this station, a large population of *Silphium laciniatum* occurs. The only other *Silphium* species in the vicinity is a population of *S. integrifolium* located some 70 m away. The presumed hybrid was found in the patch of *S. laciniatum* and presented a sharp contrast morphologically to this taxon. Voucher specimens of *S. integrifolium*, *S. laciniatum*, and the putative hybrid (*Jessee s.n.* on 3 October 2011) were deposited at the Missouri Botanical Garden herbarium (MO).

Selected morphological features contrasting the parents and their presumed hybrid at this site are summarized in Table 1. Observations of the parents made for this study do not represent rangewide measurements but rather are from plants at Jerry Smith Park. More detailed descriptions of the parental taxa in Missouri are in Yatskievych (2006) and rangewide in Clevinger (2009).

The putative hybrid generally appears irregularly intermediate between the parents (Fig. 1). It does not have basal leaves present at maturity, but the leaves tend to be strongly and progressively larger from the distal portion of the stem to its proximal portion. The uppermost cauline leaves are opposite and sparsely serrate to shallowly few-lobed, with progressively more proximal leaves showing an increase in the number and depth of the lobes. Bipinnatifid leaves are not produced.

Stem pubescence tends to be similar to that of *Silphium integrifolium* in the dense, short hairs, but scattered, longer, more strongly bulbous-based hairs are present distally in the hybrid (Fig. 2). Leaf pubescence is less easily diagnosed, but in particular, the trichomes on the proximal portion of the abaxially raised midvein are longer in *S. laciniatum* than in *S. integrifolium*, with the hybrid variable but somewhat intermediate.

Table 1. Selected morphological characteristics of *Silphium integrifolium*, *S. laciniatum*, and their putative hybrid. Note that observations are based on plants at the particular property under study and are not intended to represent rangewide measurements.

Character	*S. integrifolium* var. *integrifolium*	*S. laciniatum*	Putative hybrid
Upper cauline leaves (below inflorescence)	opposite, margins entire	alternate, margins toothed or lobed	opposite, margins toothed or lobed
Lower cauline leaves	entire	lobed to pinnatifid	irregularly lobed
Basal leaves	absent at flowering	large, present at flowering	absent at flowering
Distal stem pubescence	dense, short (0.1–0.5 mm)	moderate to dense, long 1–4 mm)	dense short + scattered long
Inflorescences	flat-topped to hemispheric-paniculiform, rarely unicapitulate	elongate, racemiform sometimes with few, ascending branches	hemispheric to ± elongate, ± paniculiform
Involucral bracts	elliptic to broadly ovate; tips angled to short-attenuate, the longest 12–15 mm	ovate to narrowly ovate, tips long-attenuate, the longest 14–22 mm	ovate to narrowly ovate, tips short- to long- attenuate, the longest 28–40 mm

In quantitative features of the head (overall size, phyllary length, number of rays, etc.) the hybrid is also more or less intermediate. Involucral bracts are ± intermediate in both shape and maximum size (Fig. 3). Receptacular bracts are too variable in shape depending on position in the head to be of use in distinguishing the parents. However, one qualitative feature of these bracts that is difficult to quantify or illustrate with photographs is their pubescence. In *Silphum integrifolium*, the chaffy bracts are pubescent dorsally with short, stiff, ascending hairs in the distal half. The apical margin is ciliate with short hairs that are not much longer than the surface trichomes. In contrast, receptacular bracts of *S. laciniatum* are pubescent dorsally in only the distal portion with trichomes that are somewhat longer than those in *S. integrifolium*. The margins are ciliate with a fringe of hairs that are longer than those of the surface. The bracts thus appear minutely comose or bearded apically (under magnification).

Achenes of the hybrids generally appear flat and inviable (Fig. 4). They lack the embedded glands characteristic of the putative parents and generally appear pale at maturity. In other respects, the achenes of the parents are too similar to offer morphological contrasts.

Discussion.

In the 1960s, several students working under T. Richard Fisher at Ohio State University completed Master's and Doctoral studies involving the biosystematics of selected species in *Silphium*. Sadly, much of this research was never published. One of the students, Wilbur Settle (1967) studied the chromosomal morphology of *Silphium* species, all of which have a chromosome number of $2n = 14$. Soon thereafter, Dennis Anderson (1968) demonstrated that three karyotypic groups could be distinguished, based on reciprocal translocations involving the two longest chromosomes. Settle and

Fisher (1972) conducted a program of artificial hybridizations between *S. integrifolium* and other members of the genus. At least some of their controlled crosses involving *S. integrifolium*, *S. asteriscus*, and S. *perfoliatum* produced hybrids with normal chromosomal pairing at meiosis that potentially were fertile. In contrast, crosses involving *S. integrifolium* and other species, such as *S. laciniatum*, resulted in hybrids with abnormal pairing at meiosis (5 bivalents and 2 quadrivalents) and thus were mostly sterile. The observation that the achenes in our putative hybrid of *S. integrifolium* × *S. laciniatum* appear flat and inviable (Fig. 3) agrees with these results.

To our knowledge, this is the first documented report from anywhere of a naturally occurring hybrid between *Silphium integrifolium* and *S. laciniatum*. It should be noted that Gardner (2011) mentioned having observed an individual of this hybrid (presumably somewhere in Illinois) that grew from seed collected from a *S. laciniatum* parent. However, he did not provide any further details and apparently did not gather a voucher specimen. It will be interesting to see whether this unusual hybrid persists in Missouri. Future studies should be conducted to confirm the parentage and hybrid status using cytological or molecular techniques.

ACKNOWLEDGEMENTS

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Figure 1. Representative stems with foliage and inflorescences of *Silphium integrifolium* (i), *Silphium laciniatum* (l), and their putative hybrid (x).

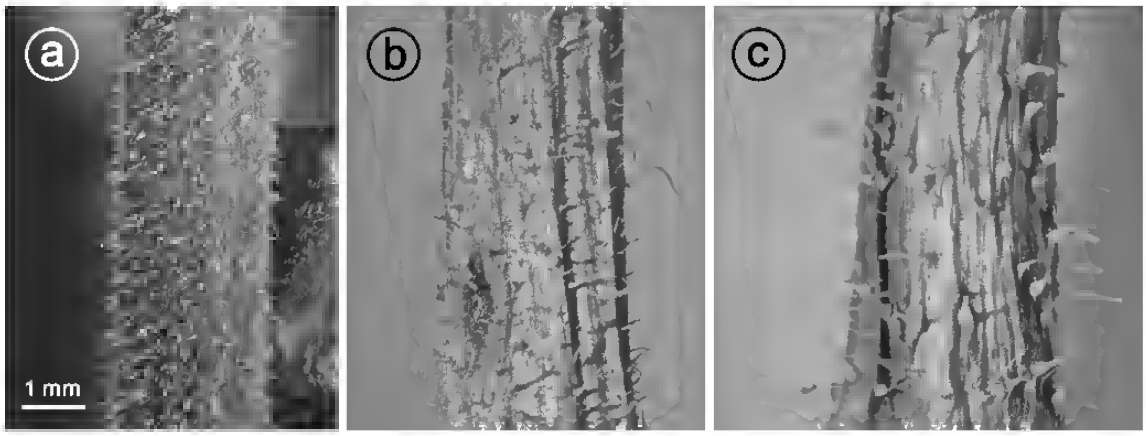

Figure 2 Pubescence of stems at the first internode below the inflorescenc a = *Silphium integrifolium*, b = putative hybrid; c = *Silphium laciniatum*

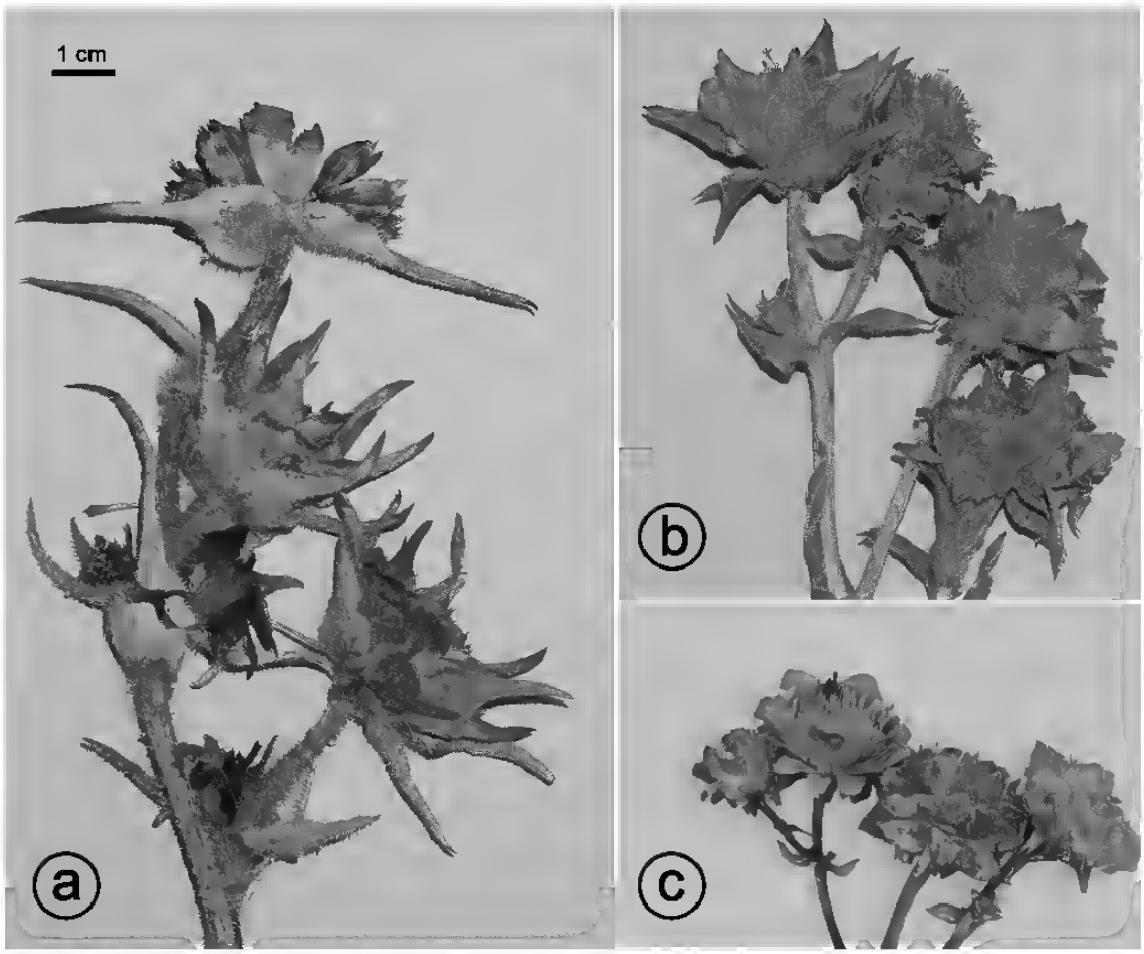

Figure 3 Representative inflorescences and heads of *Silphium laciniatum* (a), the putative interspecific hybrid (b), and *Silphium integrifolium* (c)

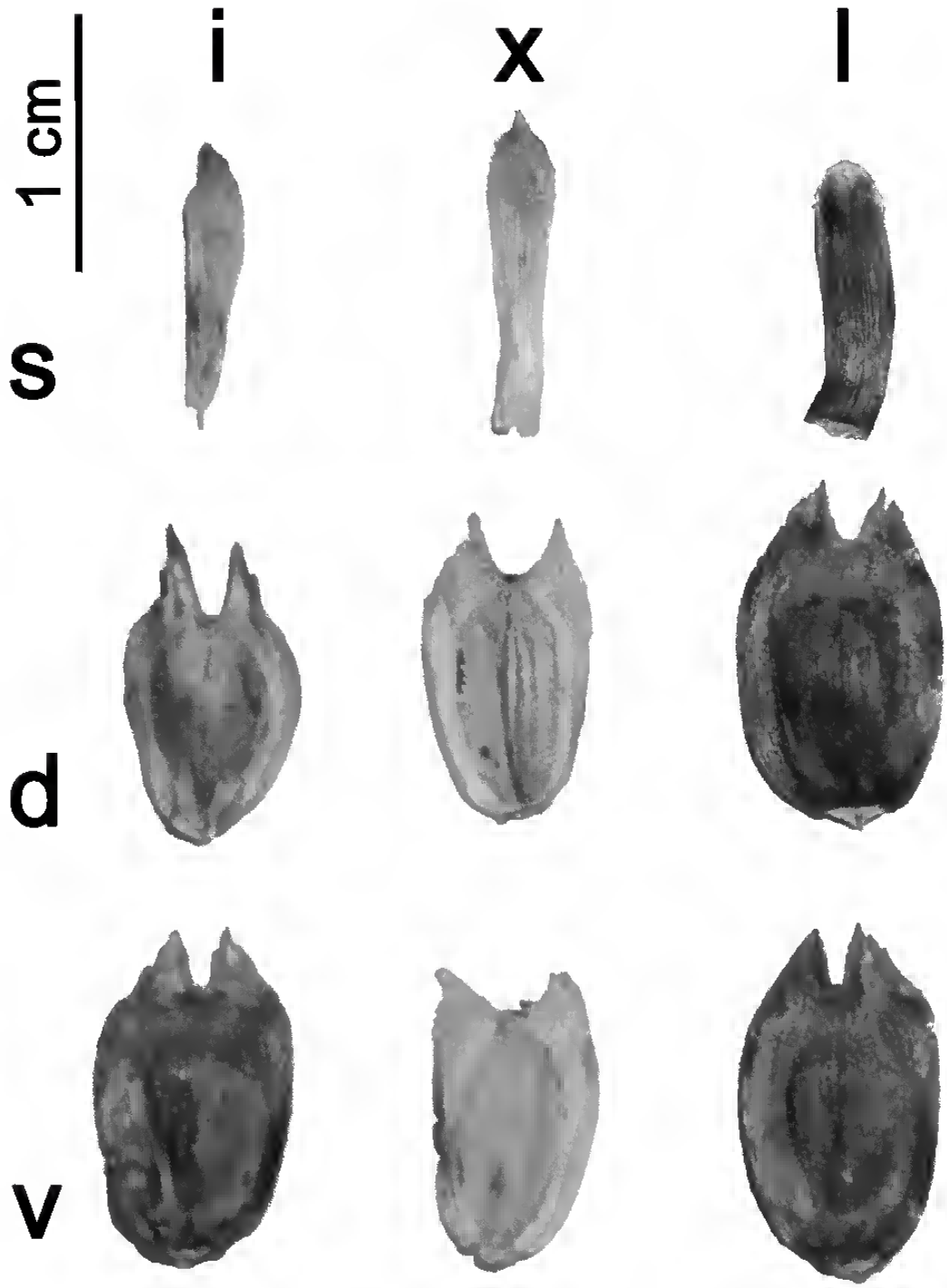

Figure 4. Representative receptacular bracts and achenes of *Silphium integrifolium* (i), *Silphium laciniatum* (l), and their putative hybrid (x). Row labels: b = bracts, d = achenes, dorsal view, v = achenes, ventral view.

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DISCOVERY OF *SPIRAEA HYPERICIFOLIA* (ROSACEAE) NATURALIZED IN TEXAS

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ABSTRACT

Spiraea hypericifolia (Rosaceae) is reported as naturalized along roadsides and in woods edges in Cass and Harrison counties of the Pineywoods of east Texas.
Key Words: Rosaceae, *Spiraea*, Texas, USA, Pineywoods

Continuing floristic study in the Pineywoods of east Texas has resulted in the discovery of naturalized populations of *Spiraea hypericifolia* L. (Rosaceae).

Voucher specimens: **TEXAS**. Cass Co.: Texas Hwy 43, 1.7 miles N of Killdare Junction, open xeric sandhill ca. 40 m from roadside right of way, associated flora included *Quercus incana, Q. stellata, Prunus pumila, Hymenopappus artemisiifolius, Croptilon divaricatum, Helianthemum georgianum, Lechea mucronata, Lechea tenuifolia, Aristida desmantha, Schizachyrium tenerum*, 5 Jan 2011, *Holmes, Singhurst, & Mink 15330* (BAYLU); same location [peak flowering], 3 Mar 2011, *Holmes 15337* (BAYLU); same location [leaf collection], 25 May 2011, *Holmes, Singhurst & Mink 15498* BAYLU); Harrison Co.: 0.95 E of Loop 390 and Texas Hwy 43 [Marshall] on Texas Hwy 43, mesic pine-oak forest ca. 30 m from roadside right of way, associated flora included *Pinus taeda, Quercus falcata, Quercus nigra, Ulmus alata, Pinus serotina, Ilex vomitoria, Ligustrum sinense, Schizachyrium scoparium, Smilax bona-nox*, 4 Mar 2011, *Singhurst et al. 18735* (BAYLU).

The genus *Spiraea* consists of 80–100 species of shrubs mainly of temperate eastern Asian distribution. They are important ornamentals, with many having escaped cultivation since their incorporation into horticulture began in 1736 (Vines 1960). Approximately 35 species are mentioned in USDA, NRCS (2011) as occurring in North America, a total that includes hybrids but not subspecific entities. Of these, approximately 12 species are considered North American natives.

Until now, no *Spiraea* has been reported as occurring outside of cultivation in Texas (Cory and Parks 1937; Vines 1960; Gould 1962; Correll & Johnston 1970; Hatch et al. 1990; Johnston 1990; Turner et al. 2003). Jones et al. (1997) cited in their checklist of the vascular plants of Texas three species and two hybrids of *Spiraea* as being cultivated. The species reported here (*S. hypericifolia*) was not among those listed in that work. Elsewhere in the USA, *S. hypericifolia* has been reported as occurring in Mississippi in USDA, NRCS (2011). It is a native of Asia.

For comparison, six *Spiraea* species are reported in Louisiana by Thomas and Allen (1998), three of which occur in parishes adjoining Texas. Four species are reported in Arkansas by Smith (1988), while none are known from Oklahoma (USDA, NRCS, 2011).

The Texas specimens were determined by use of several keys (Bailey 1949; Lu & Alexander 2003; Businský 2011), none of which is adapted for native and naturalized occurrences of *Spiraea* in North America. Inflorescence type has been one the traditional features for separating *Spiraea* species, with the main discriminator relying on one-flowered pedicels (simple inflorescences) or branched pedicels (compound inflorescences) (Businský 2011). *Spiraea hypericifolia* has sessile leafless umbels of white flowers with unbranched pedicels. Bailey (1949) characterized it as "one of the most beautiful and free-flowering of the early spring spireas."

It appears that the Texas plants arrived at the locations by natural means since there is no evidence that either site is an old homestead. The Cass Co. site consisted of seven clumps, while three clumps were at the Harrison Co. site. We observed no young plants of *Spiraea hypericifolia* at either locality. Judging from the invasive potential of at least some *Spiraea* species (e.g., *S. japonica* L.), these Texas populations necessitate monitoring efforts to determine latent distributional expansion, before eradication becomes problematic or impossible.

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FLORISTIC DISCOVERIES IN DELAWARE, MARYLAND, AND VIRGINIA

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ABSTRACT

Over the past decade studies in the field and herbaria have yielded significant advancements in the knowledge of the floras of Delaware, Maryland, and the Eastern Shore of Virginia. We here discuss fifty-two species newly discovered or rediscovered or whose range or nativity is clarified. Eighteen are additions to the flora of Delaware (*Carex lucorum* var. *lucorum, Carex oklahomensis, Cyperus difformis, Cyperus flavicomus, Elymus macgregorii, Glossostigma cleistanthum, Houstonia pusilla, Juncus validus* var. *validus, Lotus tenuis, Melothria pendula* var. *pendula, Parapholis incurva, Phyllanthus caroliniensis* subsp. *caroliniensis, Ranunculus septentrionalis, Rhynchospora rariflora, Planodes virginicum, Schoenoplectiella mucronata, Schoenoplectus purshianus* var.

williamsii, Thlaspi alliaceum). Eighteen are additions to the flora of Maryland (*Arctostaphylos uva-ursi, Cardamine impatiens, Carex fissa* var. *fissa, Carex oklahomensis, Cyperus acuminatus, Cyperus flavicomus, Eriophorum gracile* var. *gracile, Glossostigma cleistanthum, Juncus megacephalus, Lysimachia japonica, Modiola caroliniana, Platanthera shriveri, Rhamnus alnifolia, Rhynchospora inexpansa, Rubus bifrons, Schoenoplectiella mucronata, Stenanthium leimanthoides,* and *Tribulus terrestris*). Four are rediscoveries to Delaware (*Carex tetanica* var. *canbyi, Cyperus compressus, Kyllinga pumila, Phylanthus caroliniensis* subsp. *caroliniensis*) and nine reports are rediscoveries to Maryland (*Amelanchier nantucketensis, Axonopus furcatus, Ludwigia glandulosa* subsp. *glandulosa, Muhlenbergia uniflora, Puccinellia fasciculata, Ranunculus laxicaulis, Rhynchospora rariflora, Sisyrinchium arenicola, Utricularia cornuta*). Ten reports are additions to the flora of Maryland's Eastern Shore (*Calepina irregularis, Cyperus difformis, Houstonia pusilla, Juncus articulatus, Juncus elliottii* var. *elliottii, Melothria pendula* var. *pendula, Montia linearis, Parapholis incurva, Phyllanthus carolinensis* subsp. *carolinensis, Senna obtusifolia*). One report is an addition to the flora of Virginia's Eastern Shore (*Houstonia pusilla*) and another is a rediscovery (*Quercus virginiana*). Additional reports clarify the nativity of *Ludwigia leptocarpa* in Delaware, the status of *Thlaspi alliaceum* in Maryland, and the range and history of *Gelsemium sempervirens* on the Eastern Shore of Virginia. Of these reports twenty eight represent native taxa and twenty four are non-native.

Field work and herbaria study have yielded fifty-two species newly discovered or rediscovered or whose range or nativity are here clarified from Delaware, Maryland, and the Eastern Shore of Virginia. Most of these discoveries are new or rediscoveries to Delaware or Maryland. Some reports represent new documentations to areas within a state such new reports for the Coastal Plain of Delaware (Bailey 1995), the Eastern Shore of Maryland, which is the Coastal Plain of Maryland east of the Chesapeake Bay (Schmidt 1993) or the Eastern Shore of Virginia, the Coastal Plain of Virginia east of the Chesapeake Bay (Woodward and Hoffman 1991). We provide detailed information that can aid researchers in the future as well as specimen citations. Non-native species that have shown rapid expansion and establishment within the treatment area are heavily cited with specimens to help document this expansion.

Materials and Methods

Surveys yielding these discoveries were conducted for a number of different reasons and at varying intensities. Many of these discoveries were made while conducting vascular plant inventories associated with work for the Delaware or Maryland Natural Heritage Programs. Natural Heritage Program inventories include efforts associated with community classification and rare, threatened, and endangered species surveys. Some discoveries were made during independent consulting work, and others were discovered while conducting a variety of other research-based efforts.

Nomenclature follows USDA PLANTS DATABASE (2011), except for species for which we include the name found on PLANTS in brackets "[ ]" below the accepted name. We then cite the reasons for our nomenclatural difference in the species entry. Herbarium acronyms follow Index Herbariorum (2011) with the exceptions of (a) the Assateague Island Nation Seashore Herbarium (7206 National Seashore Lane, Berlin, MD), and (b) the herbarium of the Patuxent River Naval Air Station (Natural Resources Office at 22541 Johnson Rd, Building 1410, Patuxent, MD).

Results

Eighteen reports are new additions to the flora of Delaware (*Carex lucorum* var. *lucorum, Carex oklahomensis, Cyperus difformis, Cyperus flavicomus, Elymus macgregorii, Glossostigma cleistanthum, Houstonia pusilla, Juncus validus* var. *validus, Lotus tenuis, Melothria pendula* var.

pendula, Parapholis incurva, Phyllanthus caroliniensis subsp. *caroliniensis, Ranunculus septentrionalis, Rhynchospora rariflora, Planodes virgmicum, Schoenoplectiella mucronata, Schoenoplectus purshiamus* var. *williamsii, Thlaspi alliaceum*). Eighteen reports are new additions to the flora of Maryland (*Arctostaphylos uva-ursi, Cardamine impatiens, Carex fissa* var. *fissa, Carex oklahomensis, Cyperus acuminatus, Cyperus flavicomus, Eriophorum gracile* var. *gracile, Glossostigma cleistanthum, Juncus megacephalus, Lysimachia japonica, Modiola caroliniana, Platanthera shriveri, Rhamnus alnifolia, Rhynchospora inexpansa, Rubus bifrons, Schoenoplectiella mucronata, Stenanthium leimanthoides*, and *Tribulus terrestris*). Four reports are rediscoveries to Delaware (*Carex tetanica* var. *canbyi, Cyperus compressus, Kyllinga pumila, Phylanthus caroliniensis* subsp. *caroliniensis*). Nine reports are rediscoveries to Maryland (*Amelanchier nantucketensis, Axonopus furcatus, Ludwigia glandulosa* subsp. *glandulosa, Muhlenbergia uniflora, Puccinellia fasciculata, Ranunculus laxicaulis, Rhynchospora rariflora, Sisyrinchium arenicola, Utricularia cornuta*). Ten reports are additions to flora of Maryland's Eastern Shore (*Calepina irregularis, Cyperus difformis, Houstonia pusilla, Juncus articulatus, Juncus elliottii* var. *elliottii, Melothria pendula* var. *pendula, Montia linearis, Parapholis incurva, Phyllanthus caroliniensis* subsp. *caroliniensis, Senna obtusifolia*). One report is an addition to the flora of Virginia's Eastern Shore (*Houstonia pusilla*) and another is a rediscovery (*Quercus virginiana*). Additional reports clarify the nativity of *Ludwigia leptocarpa* in Delaware, the status of *Thlaspi alliaceum* in Maryland, and the range and history of *Gelsemium sempervirens* on the Eastern Shore of Virginia. Of these reports twenty eight represent native taxa and twenty four are non-native.

BRASSICACEAE

***Calepina irregularis* (Asso) Thell.**

This specimen marks an addition to the flora of the Eastern Shore of Maryland. The native range of *Calepina irregularis* is Europe and North Africa. It was first reported from Maryland by Hill (1988). In the United States this species is currently known from Maryland, North Carolina, and Virginia (Al-Shehbaz pers. comm.) and is apparently spreading. It was collected along a sandy roadside and in a recent constructed residential development and seems to grow most often in anthropogenic disturbed areas.

Voucher specimen. **MARYLAND. Dorchester Co.**: Town of East New Market, at int. of Ellwood Road and Pea Hill Rd, 4 Apr 2008, *Longbottom 10895* (MO).

***Cardamine impatiens* L.**

The specimens cited below represent the first voucher for this non-native species in Maryland. *Cardamine impatiens* was first attributed to Maryland, but apparently not vouchered, by Francis in an online checklist of the plants of Fair Hill Nature Center (2005). The discovery of *C. impatiens* from Maryland is of no surprise as it has been attributed to every bordering state (USDA Plants Database 2010). The geographic range of *C. impatiens* is through New England, southern Canada and south into the Carolinas and Kentucky (USDA Plants Database 2010).

Voucher specimens. **MARYLAND. Baltimore Co.**: Gunpowder River floodplain at Monkton, 1 June 1986, *Davis 7236* (BALT). **Cecil Co.**: Funk's Pond Recreation Area, N of Rt. 1 just E of Susquehanna River, abundant along dirt path in mixed hardwood forest, 20 May 2010, *Knapp 3061 & Harrison* (TAWES).

Planodes virginicum **(L.) Greene**

[*Sibara virginica* (L.) Rollins]

The specimen cited below is apparently the first collection of *Planodes virginicum* from Delaware. The previously known range of this mustard is the southeastern U.S.: Maryland to Kansas, south to Florida and Texas (Al-Shehbaz 2010, Brown & Brown 1984; Gleason & Cronquist 1991). Given the proximity of previously known, presumably native occurrences in states near Delaware [e.g., Anne Arundel Co., Maryland (Brown & Brown 1984), and Fairfax Co., northern Virginia (V.B.A. 2010), both at about the same latitude as the Delaware locality], this species may be a native plant in Delaware. However, its ruderal nature makes determining its status as a native plant problematic. The Delaware population of *P. virginica* occurred in the sunny, gravelly, weedy edge of an unpaved road through a periodically mowed, grassy area. Plants were frequent at the site.

Voucher specimen. **DELAWARE. Kent Co.**: ca. 2.5 mi N of center of Dover, 22 Apr 2005, *Naczi 10767 & Thieret* (DOV).

Thlaspi alliaceum **L.**

This alien mustard, native of Europe, is rapidly spreading and is now found with regularity in Delaware and Maryland. The collections cited below represent the first collections from Delaware, the Eastern Shore of Maryland, and eastern Virginia. Shetler and Oril (2000) attributed the species to Maryland but only as a waif from Howard County. Given the additional counties documented below and the frequency of the species' occurrence in Maryland, we consider this an established component of the flora. All populations of this species are from ruderal habitats, especially sandy soils along corn fields and roadsides.

Voucher specimens. **DELAWARE. New Castle Co.**: Along Rt. 1 at int. of Rt. 299, along road side embankment, 23 Mar 2009, *Longbottom 12440* (DOV). **Kent Co.**: S the town of Dover, Rt. one about 1/3 mi S of DE Rt. 9, 1 Apr 2009, *Longbottom 12545* (DOV). **Sussex Co.**: E the town of Greenwood along Rt. 16, 13 Apr 2007, *Longbottom 8434* (DOV). **MARYLAND. Anne Arundel Co.**: Town of Jessup, along MD Rt 295 and Rt 175, 8 Apr 1991, *Longbottom 1482* (NY). **Baltimore Co.**: weed in cultivated field W of Owings Mills Boulevard and N of Gwynbrook Ave, Apr 2010 *Davis 309* (BALT). **Caroline Co.**: NE of Federalsburg along Noble Road at Marshyhope Creek at Idylwild Wildlife Management Area, 8 May 2005, *Longbottom 5769* (DOV). **Dorchester Co.**: Town of Secretary along Rt. 14 ca. 0.4 km N of Rt 16, 20 Apr 2007, *Longbottom 8456* (DOV). **Harford Co.**: Swan Park, Sandbar in Gashey's Run, 21 Apr 2002 *Davis 7265 & Davis* (BALT). **Howard Co.**: Town of Columbia along MD Rt. 108, Clarksville Pike, 16 Apr 2009, *Longbottom 12498* (DOV). **Queen Annes Co.**: Town of Queenstown along Rt. 50, E of St. Peters Church, 19 Apr 2009, *Longbottom 12512* (DOV). **Somerset Co.**: NW of Pocomoke City along Dublin Road at Follow Ditch Rd, 29 Apr 2007, *Longbottom 8558* (DOV). **Washington Co.**: Pearre Rd, along edges of road at the school bus turn around, 28 May 2006, *Longbottom 7354 et al.* (MU). **Wicomico Co.**: Town of Fruitland along roadside at int. of Rt. 13 and Rt. 513, 7 Apr 2008, *Longbottom 10915* (DOV), **Worcester Co.**: NW the town of Snow Hill, along Rt. 12 at int with Old Furnace Rd, 2 Apr 2006, *Longbottom 7075* (DOV). **VIRGINIA. Accomack Co.**: Along US Rt. 13 at Bishop Rd along edge of agricultural field, 22 Mar 2009, *Longbottom 12440* (NY).

CUCURBITACEAE

Melothria pendula **L. var.** ***pendula***

The collections cited below represent an addition to the flora of Delaware and the first report of this species from the Eastern Shore of Maryland (Maryland Natural Heritage Program pers. comm.). Both populations of this species are presumably non-native. The Delaware population is located along the base of a Mill Pond and the Maryland population is located in a heavily urbanized

area of Ocean City growing along a fence. Currently, *M. pendula* is extant to the south in Accomack and Northampton Counties, Virginia (V.B.A. 2010) and it is apparently expanding its range northward. In North America this species is ranges from Washington D.C., Maryland, and Virginia, west to Indiana, south to Florida and Texas (Weakley 2010).

Voucher specimens. **DELAWARE. Sussex Co.**: SW the town of Seaford at Craig's Mill Pond, at int. of Figgs Road and Craig's Mill Pond Road along edge of wooded swamp at base of dam, 30 Aug 2007, *Longbottom 10343* (DOV). **MARYLAND. Worcester Co.**: Town of Ocean City at the W end of 83rd Street, growing along fence, 25 Jul 2007, *Longbottom 9910* (DOV).

CYPERACEAE

Carex fissa* Mackenzie var. *fissa

These specimens appear to be the first of *Carex fissa* for Maryland. The native range of *C. fissa* var. *fissa* is the midwestern USA, Kansas south to Texas (Standley 2002). Evidently, *C. fissa* is a recent arrival in Maryland. A few plants were found growing in a roadside ditch where plastic netting was in place. This suggests that this species may have been included in a seeding mixture to stabilize the ditch bank. Recent literature documents the spread of *C. fissa* to eastern North America (in Virginia: Simmons et al. 2008) as well as to Japan (Katsuyama 2003).

Voucher specimens. **MARYLAND. Talbot Co.**: Easton, along route 331, 6 June 2006, *Longbottom 7461* (DOV), 13 Jun 2007, *Longbottom 9355* (DOV).

Carex lucorum* Link var. *lucorum

Carex lucorum is native to northeastern U.S.A. and adjacent Canada (Crins & Rettig 2002). Though it is known adjacent to northern Delaware in the Piedmont of Maryland and Pennsylvania (Rhoads & Klein 1993; Frye & Lea 2001), and the adjacent Coastal Plain of Cecil Co., MD (*McAvoy 5832* DOV), the species had not been recorded from Delaware (Tatnall 1946; McAvoy & Bennett 2001; Crins & Rettig 2002). Delaware forms the southeastern limit of the geographic distribution of the species (Crins & Rettig 2002). Obviously, the great age of the vouchers mean the species must be considered historic in the state.

Voucher specimens. **DELAWARE. New Castle Co.**: Point Lookout, June 1863, *Canby s.n.* (NY); [no additional locality data], May 1862, *Canby s.n.* (NY).

***Carex oklahomensis* Mackenzie**

These specimens of *Carex oklahomensis* are new state records for both Delaware and Maryland. The previous report of this species from both states in *Flora of North America* (Ball & Reznicek 2002) resulted from oral communications of our discoveries to volume editor Reznicek while the FNA volume was in press. Here we present the voucher data that support our discoveries of this sedge in these states.

The discoveries of *Carex oklahomensis* in Delaware and Maryland date from May 2002, with independent and nearly simultaneous collections of it in Kent Co., Delaware, and Cecil Co., Maryland. Subsequent discoveries have increased its known range to most counties of Delaware and the Eastern Shore of Maryland.

Though *Carex oklahomensis* is native to North America, it is not native to Delaware and Maryland. Its native range is far to the west, in the Midwest (at least Arkansas, Kansas, Missouri, Oklahoma, and Texas, and possibly also Indiana and Kentucky). These vouchers add to the growing list of states from which *C. oklahomensis* has been discovered recently, mostly from collections made

within the past 20 years. Most of these states are clearly outside of the native range of the species: Indiana in 1935 (R. Dolan, pers. comm.; M. Homoya, pers. comm.), Kentucky in 1970 (Naczi et al. 2002); North Carolina in 1984 (Jones & Reznicek 1995), Mississippi in 1992 (Bryson et al. 1992), Virginia in 1995 (Wieboldt et al. 1998), Tennessee in 1996 (Bryson et al. 1996), Louisiana in 1997 (Bryson & Rothrock, 2010), Illinois in 2002 (S. R. Hill, pers. comm.), Maine in 2003 (Angelo and Boufford 2007; A.V. Gilman, pers. comm.), Alabama in 2006 (Bryson & Rothrock 2010), and Georgia in 2009 (Bryson & Rothrock 2010). Obviously, *C. oklahomensis* is rapidly expanding its geographic range, with the pace of expansion apparently accelerating.

All of the known Delaware and Maryland populations of *Carex oklahomensis* are on regularly mowed roadsides. The specific habitats are sunny, wet sites, usually ditches, but one site was at the edge of a sediment control pond (*Davis 6169*). Bryson et al. (1992, 1996) reported *C. oklahomensis* from roadsides in Mississippi and suggested that the spread of the species was likely aided by human activities.

Most of these populations of *Carex oklahomensis* are large, dense, and weedy. For example, in Caroline Co., Maryland (*Longbottom 6179*), the population stretched at least 154 meters (504 feet) along a road, and covered ca. 165 m^2. In Wicomico Co. (*Longbottom 6245*), the population stretched at least 485 meters (1590 feet, 0.3 mile) along a road. Though the Kent Co., Delaware, population (*Naczi 9373*) was small, it is typical in its density: 177 fruiting culms in a total area of 0.9 m^2.

Though it is weedy and not native to Delaware or Maryland, *Carex oklahomensis* is not an invasive species in these states. In this region, populations of this sedge are known only from actively managed roadsides. The species has not been discovered in natural habitats.

Voucher specimens. **DELAWARE**. **Kent Co.**: 1.6 mi NW of Hartly, 23 May 2002, *Naczi 9311 et al.* (DOV), 13 Jun 2002, *Naczi 9373* (DOV, US), 23 May 2006, *Longbottom 7346* (DOV). **Sussex Co.**: Along route 9, 0.5 mi W of route 30, 7 Jun 2008, *Longbottom 11555* (NY). **MARYLAND**. **Caroline Co.**: Federalsburg, 26 Jun 2005, *Longbottom 6179* (DOV), 2 Jul 2005, *Longbottom 6222* (DOV), 2 Jul 2005, *Longbottom 6224* (DOV), 15 Jun 2006, *Longbottom 7544* (NY), 9 Jun 2008, *Longbottom 11579* (NY). **Cecil Co.**: N of route I-95, W of route 275, 29 May 2002, *Davis 6169* (DOV). **Dorchester Co.**: NW of Linkwood, 3 Jun 2009, *Longbottom 12903* (NY). **St. Mary's Co.**: Webster Field, 2.2 mi from St Inigoes, MD, US Navy, wet mowed roadside, 6 Jun 2008, *C. Davis 7248* (NY). **Wicomico Co.**: Pittsville, 5 Jul 2005, *Longbottom 6245* (DOV), 7 Jun 2008, *Longbottom 11556* (NY). **Worcester Co.**: along route 376, between Ayers Creek and route 611, 2 Jul 2008, *Longbottom 11694* (DOV, NY).

***Carex tetanica* Schkuhr var. *canbyi* Porter**

[included within *Carex tetanica* Schkuhr]

Though it is morphologically and geographically distinctive, recent authors of floristic accounts have not mentioned this taxon, perhaps because of the incompletely resolved problem of distinguishing *Carex tetanica* and *C. meadii* Dewey (Rothrock & Reznicek 2002; Rothrock 2007). The taxonomic status of this sedge warrants study. *Carex tetanica* var. *canbyi* is known to be extant at fewer than ten sites and appears to be native to only a small region: northernmost Delaware, northeastern most Maryland, and southeastern Pennsylvania (Naczi, unpubl. data).

Both Tatnall (1946) and McAvoy and Bennett (2001) treated the sole Delaware occurrence of this taxon as *Carex meadii*. The historic collection is from "N of Rockland" in 1893 (Tatnall 1946). After years of searching, Naczi rediscovered the taxon at the edge of a marsh on the floodplain of the Brandywine Creek and also from north of Rockland. Thus, this recently discovered population may be the same as the historic population, though the vagueness of the label data makes the exact

location of the historic site uncertain. The vouchers cited below represent the rediscoveries in 1999 and 2010 to document the continue presence of the sedge at the site. Only one patch that is 2–3 meters long is known in Delaware. Upon the return visit in 2010, Naczi noticed a dramatic increase in the frequency and density of the invasive grass *Phalaris arundinacea* L. at the site. If unchecked, the spread of *P. arundinacea* likely will eliminate this rare sedge from Delaware.

Voucher specimens. **DELAWARE. New Castle Co.**: ca. 0.5 mi NE of Granogue, 30 May 1999, *Naczi 8075* (MICH); same site, 2 Jun 2010, *Naczi 13091* (NY).

***Cyperus acuminatus* Torrey & Hooker**

This is the first vouchered report of this species to the State of Maryland. Brown and Brown (1984) reported the species to be present yet no specimen can be found confirming the report. The Flora of North America doesn't attribute this species to Maryland (Tucker et al. 2002). *Cyperus acuminatus* is currently known from the adjacent and surrounding states of Pennsylvania and Virginia (Tucker et al. 2002).

Voucher specimens. **MARYLAND. Co.: St. Mary's Co.**: Patuxent River Naval Air Station, West Campground, N 38.2919, W 76.45509, 25 Sep 2003, *Davis 7227b* (Herb. Patuxent River Naval Air Station); Southeast corner of Naval Air Station, N 38.2642, W 76.4163, 24 Jul 2003, *Davis 7228* (Herb. Patuxent River Naval Air Station).

***Cyperus compressus* L.**

Cyperus compressus is a pantropical weed that usually grows in sunny, recently disturbed ground (Gleason & Cronquist 1991; Tucker et al. 2002; Bryson & Carter 2008). Though regarded as native to North America by some authors (Tucker et al. 2002), others consider it of probable Asian origin (Bryson & Carter 2008).

McAvoy & Bennett (2001) listed *Cyperus compressus* as historical and of conservation concern in Delaware. The collection cited below is apparently the only recent record of the species for the state. Given that it was growing in a lawn and an abundant weed there, we suggest it be removed from the list of plant species of conservation concern for Delaware.

Voucher specimen. **DELAWARE. Sussex Co.**: Laurel, 10 Oct 2006, *T. Davis s.n.* (NY).

***Cyperus difformis* L.**

These collections appear to be the first of *Cyperus difformis* for Delaware and the first for Maryland's Eastern Shore. The first collection from Maryland was on the Western Shore in 2000 (Strong & Simmons 2002). This annual sedge is introduced in North America but transcontinental in the southern portion of the U.S.A.. (Tucker 2002). As reviewed by Strong and Simmons (2002), this species has spread rapidly in the USA. The Sussex Co. population was in a ditch, but all others grew in small, artificial water retention basins at the edges of roads. *Cyperus difformis* is a major weed (Bryson & Carter 2008).

Voucher specimens. **DELAWARE. Kent Co.**: Dover, 14 October 2005, *Naczi 11169* (DOV); Smyrna, 2 Sep 2007, *Longbottom 10414* (DOV, NY), same site, 9 Nov 2008, *Longbottom 12383 & Treher* (NY). **New Castle Co.**: Bear, 31 Aug 2008, *Longbottom 12105 & Treher* (NY). **Sussex Co.**: Fenwick Island, 10 Sep 2008, *Longbottom 12169* (DOV, NY). **MARYLAND. Queen Anne's Co.**: Stevensville, 30 Aug 2008, *Longbottom 12091* (NY). **Wicomico Co.**: Salisbury, 14 Aug 2008, *Longbottom 12008* (NY), 17 Aug 2008, *Longbottom 12016 & Van Velsir* (NY), 20 Sep 2008, *Longbottom 12225* (NY).

***Cyperus flavicomus* Michaux**

These collections mark the first reports of *Cyperus flavicomus* for both Delaware and Maryland. This annual sedge is introduced in North America but widespread in the southern USA. (Tucker 2002). The Sussex Co. population was in the bottom of a pond that had drained a few months previously because of a burst dam. All the Maryland populations were in small, artificial water retention basins at the edges of roads or parking lots. *Cyperus flavicomus* is a minor weed (Bryson & Carter 2008).

Voucher specimens. **DELAWARE. Kent Co.**: Hickory Hill, 14 Sep 2001, *Rash s.n.* (DOV). **Sussex Co.**: 2.7 mi NNE of Seaford, Hearns Pond, 29 Sep 2001, *Naczi 8908* (DOV). **MARYLAND. Dorchester Co.**: Cambridge, along route 343, 6 Sep 2007, *Longbottom 10451* (NY). **Wicomico Co.**: Salisbury, 19 Aug 2007, *Longbottom 10138* (NY); Fruitland, 29 Aug 2007, *Longbottom 10324* (NY). **Worcester Co.**: Ocean Pines, 3 Sep 2008, *Longbottom 12155* (NY).

Eriophorum gracile* L. var. *gracile

An addition to the flora of Maryland, *E. gracile* is a circumboreal species with the previously known southernmost location in Franklin County, Pennsylvania (Rhoads and Klein 1993). The discovery of this sedge in Garrett County, Maryland, is a significant southern extension onto the Allegheny Plateau Physiographic Province.

Voucher specimen. **MARYLAND. Garrett Co.**: wet meadow/glade in the vicinity of McHenry, Maryland, growing with *Alnus rugosa*, *Carex lasiocarpa*, *C. echinata* and *C. atlantica* subsp. *atlantica*, 23 Jun 1998, *Frye 1088* & *Berdine* (TAWES).

***Kyllinga pumila* Michaux**

Tatnall (1946) recorded *Kyllinga pumila* [as *Cyperus temuifolius* (Steudel) Dandy] from one collection from Sussex County in 1875. The specimens cited below represent the rediscovery of *K. pumila* in Delaware, after a hiatus of 126 years. This annual sedge grows spontaneously on the former residential property of Naczi. He noticed it there within a few months of moving to the property in 2001, and plants of this species appeared every year since that time. Plants of *K. pumila* are abundant and grow in ground recently made available for plant colonization by removal of a swimming pool (*8734*), recently tilled ground in a vegetable garden (*10074*, *12608*), and in localized areas of a lawn (*12607*). Common elements of these habitats are the sunny, moist, sandy, frequently disturbed substrates.

Kyllinga pumila may be native to Delaware, or it may be adventive. The species ranges widely in early successional habitats in warm temperate and tropical regions and is often weedy (Bryson & Carter 2008). Determining the native range of such species is problematic, especially because human activities tend to allow these species to expand their ranges. The occurrences of *K. pumila* in New York (Weldy & Werier 2010) and Pennsylvania (True 1931) are clearly adventive, whereas it is almost certainly native in Virginia (Bryson et al. 1997; V.B.A. 2010).

In Delaware, McAvoy and Bennett (2001) considered *K. pumila* to be a species of conservation concern. Given the surprising abundance of the species in anthropogenic habitats in Delaware, we recommend it no longer be considered of conservation concern in the state.

Voucher specimens. **DELAWARE. Kent Co.**: 0.5 mi NNW of Dinahs Corner, 25 Aug 2001, *Naczi 8734 et al.* (DOV), 24 September 2003, *Naczi 10074* (DOV); 27 Aug 2009, *Naczi 12607* (NY), 29 Aug 2009, *Naczi 12608* (NY).

***Rhynchospora inexpansa* (Michaux) Vahl.**

This is the first report of this species from Maryland. *Rhynchospora inexpansa* is a Coastal Plain species ranging from southeast Virginia to northern Florida, Texas, Arkansas, Cuba, and Hispaniola (Godfrey & Wooten 1979). The nativity of *R. inexpansa* in Maryland is currently in question due to an apparent expansion of the species range northward in recent years. The first Eastern Shore of Virginia collections of *R. inexpansa* were in 1935 by Fernald, Long, and Fogg (*5246* PH) in Northampton Co., Virginia., and then by R. Tatnall from the same location in 1936 (*3216* DOV). Though this population is thought to be destroyed (McAvoy pers. comm.), McAvoy located *R. inexpansa* in the general vicinity in 1996 (McAvoy 2000). That same year, McAvoy discovered *R. inexpansa* in Sussex Co., Delaware (McAvoy 2000). McAvoy's Sussex Co. collection is the northernmost range-wide population and was an addition to Delaware's flora. The population reported here from Worcester Co. lies between the Northhampton Co. population and the Sussex Co. population.

The Sussex County, Delaware population reported by McAvoy (2000) is almost certainly a recent introduction. McAvoy discovered this population in a powerline right-of-way in 1996. In the early 1980s, Naczi extensively explored the same right-of-way (confirmed through recent discussions between Naczi and McAvoy) but never observed *R. inexpansa* there. *Rhynchospora inexpansa* is both common and weedy throughout the southeastern USA (Godfrey & Wooten 1979; Bryson & Carter 2008), making its eventual range expansion to Delaware and Maryland likely.

Voucher specimen. **MARYLAND. Worcester Co.**: South side of Forest Lane Road ca. 1700 feet east from the int. of Voting House Road, 14 Jul 2004, *Knapp 641 & Frye* (TAWES).

***Rhynchospora rariflora* (Michaux) Elliott**

These collections document a rediscovery of the species in Maryland and a new addition to the flora of Delaware. Prior to the Maryland collection listed below, *Rhynchospora rariflora* was historical in Maryland known from only a single collection made in 1940 from Wicomico Co., Maryland ("sphagnum bog, 7 miles E.S.E. of Salisbury and 4 miles SW of Parsonsburg in Wicomico Co.," 4 August 1940, *Norton, s.n.*, MARY). The overall geographic distribution of the species is primarily Coastal Plain, from southern New Jersey to Florida, west to Texas and southward into the tropics (Gleason & Cronquist 1991; Thomas 1994). Habitat for the species at the Sussex Co. location is a forested wetland within the inner-dunes along Delaware's Atlantic coast. *Rhynchospora rariflora* is rare here (only 4 plants) and occurs within canopy gaps with partial sun.

Habitat at the Prince Georges Co. location is a well botanized "Magnolia Bog." Magnolia Bogs are globally rare, terraced seepage wetland communities located along the fall-line and composed of nutrient-poor sand and gravel substrates (McAtee 1918). *Rhynchospora rariflora* is rare here with a population of 12 plants. Though there are many known introductions of showy plants at Suitland Bog (e.g. *Sarracenia purpurea* L. and *Drosera filiformis* Raf.), *R. rariflora* may be native to the site and not an accidental introduction. The known introductions at Suitland are believed to be from northern states, most probably New Jersey (M. Strong pers. com.). In New Jersey, *R. rariflora* is known from a sole location, Bennett Bog. Bennett Bog is a Coastal Plain seasonal pond that doesn't contain any of the supposed introductions at Suitland Bog. Thus, *R. rariflora* could not have been an accidental introduction from an intentional planting originating from New Jersey. It is entirely possible that unknown and intentional plantings from southeast Virginia could have accidently introduced this species at Suitland Bog.

Voucher specimens. **DELAWARE. Sussex Co.**: Forested wetland in the inner-dunes, growing in partial sun on poorly drained ground, east of Rt. 1, north of Bethany Beach, 23 Jul 2002, *McAvoy 5600* (DOV). **MARYLAND. Prince Georges Co.**: Suitland Bog, small open headwater

seepage area, on sole isolated tussock, 1200 ft. N the int. of Suitland Rd. and Suitland Parkway, 18 Jul 2007, *Knapp 2324 et al.* (US).

Schoenoplectiella mucronata **(L.) J. Jung & H.K. Choi**

[*Schoenoplectus mucronatus* (L.) Palla]

Schoenoplectiella mucronata is a serious weed of warm-temperate and tropical regions (Bryson & Carter 2008). Its native range appears to be eastern Asia. This species was introduced to eastern North America prior to 1900, but the early introductions did not persist (Smith 2002). Much more recent discoveries in the East are represented by published reports from Illinois (Schwegman 1984), then Iowa (Wilson 1992), Tennessee (Churchill 1992), Missouri (Smith & Yatskievych 1996), Kentucky (Libby et al. 1997), Pennsylvania (Rhoads & Block 2007), Indiana (Rothrock 2009), New York (New York Flora Association 2010), Virginia (DeBerry et al. 2010), and Ohio (Vincent et al. 2011).

Here we cite the first records known for *Schoenoplectiella mucronata* from Delaware and Maryland. Our collections document 25 sites from 8 counties in Delaware and Maryland. Thus, the species appears to be firmly established in the region.

As with most, if not all, of the other populations known in eastern USA, the Delaware and Maryland populations are from anthropogenic habitats — constructed water retention basins, wetlands subjected to ecological restoration activities, and margins of ponds with frequent human visitation. Apparently, all the Delaware and Maryland habitats were recently created or extensively disturbed. This fact suggests that *S. mucronata* is a pioneer, growing in early-successional habitats. Furthermore, we have never observed *S. mucronata* in undisturbed, natural habitats. Thus, at least in Delaware and Maryland at this time, *S. mucronata* is not invasive.

Most recent authors have referred to this species as *Schoenoplectus mucronatus*. Very recent taxonomic revision, based on molecular and morphologic data, supports changing the name to *Schoenoplectiella mucronata* (Lye 2003; Jung & Choi 2010).

Voucher specimens. **DELAWARE. Kent Co.**: NW of Kenton, 12 Aug 1994, *McAvoy 701* (DOV); E of Smyrna, 23 Sep 2003, *McAvoy 5944* (DOV, NY); Smyrna, 22 Aug 2004, *Alsfeld s.n.* (DOV); Clayton, 23 Aug 2004, *Alsfeld s.n.* (DOV); Sandtown, 26 Aug 2004, *Alsfeld s.n.* (DOV); Hartly, 31 Aug 2004, *Alsfeld s.n.* (DOV); Kenton, 3 Sep 2004, *Alsfeld s.n.* (DOV); Willow Grove, 8 Sep 2004, *Alsfeld s.n.* (DOV); Smyrna, 2 Sep 2007, *Longbottom 10404* (BRIT, DOV, MICH, MO, MU, NY, PH), 2 Sep 2007, *Longbottom 10411* (DOV, MO, NY), 9 Nov 2008, *Longbottom 12382 & Treher* (NY); Dover, ca. 0.3 mi S of Forrest Avenue, 25 Aug 2007, *Naczi 12002* (DOV, NY), nearby site, *Naczi 12004* (NY); Dover, SE of junction of route 8 and Mifflin Road, 25 Aug 2007, *Naczi 12006* (DOV, NY); Dover, campus of Delaware State University, 15 Sep 2007, *Naczi 12055* (NY); Dover, route 15, 16 Oct 2007, *Longbottom 10725* (BRIT, DOV, MICH, MO, MU, NY, PH). **New Castle Co.**: W of Summit Bridge, 18 Jul 2002, *McAvoy 5597* (DOV). **Sussex Co.**: University of Delaware Experimental Station, 8 Sep 2003, *Jacobs & Rokosch s.n.* (DOV); Lewes, 14 Aug 2007, *Longbottom 10050* (DOV, MO, MU, NY), 19 Sep 2008, *Longbottom 12222* (NY); town of Rehoboth Beach, 23 Aug 2008, *Longbottom 12060* (NY). **MARYLAND. Caroline Co.**: 2.2 mi NE of Goldsboro, 23 Aug 2007, *Knapp 2273* (DOV), same site 16 Nov 2008, *Groller 0081116* (NY). **Dorchester Co.**: 0.2 mi NE of Galestown, 17 Jun 2007, *Knapp 2273* (DOV). **Kent Co.**: Millington WMA, Sep 1996, *Tyndall s.n.* (DOV); W of Betterton, 31 Aug 2001, *McAvoy 5258* (DOV); 2.5 mi SSE of Golts, 13 Oct. 2001, *Naczi 8991* (BRIT, DOV, MICH, MO, MU, NY, PH); W of Millington, 26 Aug 2007, *Longbottom 10283* (BRIT, DOV, MICH, MO, MU, NY, PH). **Queen Anne's Co.**: Kent Island, adjacent to Kirwan Creek, off Prospect Bay, 10 Sep 1999, *Sipple 2029* (DOV). **Wicomico Co.**: Delmar, 19 Aug 2007, *Longbottom 10145* (BRIT, DOV, MICH, MO, MU, NY, PH).

***Schoenoplectus purshianus* (Fernald) M.T. Strong var. *williamsii* (Fernald) S.G. Smith**

[included within *Schoenoplectus purshianus* (Fernald) M.T. Strong]

This sedge is known from the sandy margins of ponds and lakes with dramatically fluctuating water levels (Schuyler 1972; Smith 2002). It is known from only a few counties in Indiana, Massachusetts, Michigan, and Wisconsin (Smith 2002). The discovery of the Delaware populations represents a new state record and a substantial range extension.

At the first Delaware site, a few (about five in 2001 and only one in 2003) plants of *Schoenoplectus purshianus* var. *williamsii* grew on the moist, sandy shore of a small pond with greatly fluctuating water levels. Vascular plant associates on the pond shore included a moderately diverse group of native herbs: *Cyperus strigosus*, *Eleocharis engelmannii*, *Fimbristylis autumnalis*, *Juncus effusus*, *J. scirpoides*, *Ludwigia palustris*, *Rotala ramostor*, *Scirpus cyperinus*, *Typha angustifolia*, and *T. latifolia* L. The pond is presently a water retention basin, but study of the 1997 aerial photograph of the site and its vicinity (Delaware Geological Survey 2010) reveals natural ponds present in the immediate area. Sometime after the 1997 photograph, the area was affected by road construction to connect Scarborough Road with McKee Road. It is likely the sedge was native to at least one of the original ponds and either persisted after its modification or served as a nearby seed source for the retention basin. An alternative scenario is possible, though seemingly less likely — that the sedge was introduced at the time of modification.

Repeat visits to the pond during most years since the discovery of this sedge have not yielded it since 2003. Possibly, the recent substantial increase in number of plants of *Typha angustifolia* at the site has been deleterious to the sedge.

At the second site, five plants of *Schoenoplectus purshianus* var. *williamsii* grew in shallow water with *Pontederia cordata*, *Scirpus cyperinus*, *Typha angustifolia*, and *T. latifolia*. As well, five plants of *Schoenoplectiella mucronata* grew within a few meters of *S. purshianus* var. *williamsii*. This site is a water retention basin surrounded by commercial development. The presence of the rare *S. purshianus* var. *williamsii* at this site is mysterious, though the first site is only 2.2 mi (3.6 km) NNW of this site. Perhaps the two known populations are vestiges of a predevelopment, formerly extensive population in the area.

For this taxon, we use the nomenclature of Smith (2002), because the appropriate combination for the variety in *Schoenoplectiella* has not been published. Lye (2003) described *Schoenoplectiella* as a new genus, segregated it from *Schoenoplectus*, and transferred several species (but not infraspecific taxa) to the new genus, including *Schoenoplectiella purshianus*.

Voucher specimens. **DELAWARE. Kent Co.**: ca. 3 mi NW of center of Dover, along W side of Scarborough Road, just N of its junction with McKee Road, 20 Oct. 2001, *Naczi 8995* (DOV), same site, 5 Nov. 2003, *Naczi 10097* (DOV, MO, MU, NY); Dover, ca. 0.3 mi S of Forrest Avenue, 25 Aug 2007, *Naczi 12005* (NY).

ERICACEAE

***Arctostaphylos uva-ursi* (L.) Sprengel**

An addition to the Flora of Maryland, *Arctostaphylos uva-ursi* is the most widely distributed species of *Arctostaphylos* in North America, occurring in a wide variety of open, acidic habitats often in sandy or rocky soils. However, in the southeastern USA the species is very rare, occurring at a single station in Delaware where it is now believed to be extirpated (McAvoy pers. observ.) and one site in Virginia (V.B.A. 2010).

Voucher specimen. **MARYLAND. Allegany Co.** exposed shale along ridgeline above Sideling Hill Creek, 4 Apr 1998, *Frye, with Thompson and Berdine photo voucher* (TAWES).

FABACEAE

***Lotus tenuis* Waldst. & Kit ex Willd.**
[*Lotus glaber* Mill.]

This non-native and weedy legume is generally rare and sporadic in eastern North America but more frequent in the West (Barneby 1989; Gleason & Cronquist 1991; Weakley 2010). This collection is apparently the first for Delaware. It was abundant on the sides of a little-used road and in an adjacent field, both at the edge of a salt marsh.

Voucher specimen. **DELAWARE. Kent Co.**: 2.0 mi W of town of Woodland Beach, 10 Aug 2010, *Naczi 13269* (NY).

***Senna obtusifolia* (L.) Irwin & Barneby**

This is an addition to the flora of the Eastern Shore of Maryland. This species was reported in Brown & Brown (1984) as *Cassia torta* L. but no locality information was given other than "rich moist soil and waste areas". This species was discovered growing in a sediment control pond along a major highway in Maryland. Currently, *S. obtusifolia* is known from New York and Massachusetts, south throughout the southeastern and central USA, west to Texas and disjunct in California (USDA Plants Database 2010).

Voucher specimen. **MARYLAND. Wicomico Co.**: Town of Fruitland at the Southtowne Commons Shopping Center, at int of Rt. 13 and 513, 29 Aug 2007, *Longbottom 10326* (DOV).

FAGACEAE

***Quercus virginiana* P. Miller**

Quercus virginiana, live oak, is a southeastern Coastal Plain endemic near its northern limit in Northampton Co., Virginia. This report is a rediscovery to the Eastern Shore of Virginia. It was first documented on Virginia's Eastern Shore from Northampton Co., Virginia in 1935 ("only one clump seen, peaty clearing south of Townsend," 14 October 1935, *Fernald, Long & Fogg 5292*, PH). Robert Tatnall collected it from the same location in 1937 ("thicket, just south of Townsend on the east side of highway, 1 June 1937, *Tatnall 3369*, PH) and pointed out in his Flora of Delaware and the Eastern Shore (1946) that *Q. virginiana* is "known on this Peninsula from a single shrubby specimen" (Tatnall 1946). It is believed that this location has been destroyed. Live oak was reported as being observed but not vouchered in 1970 from Smith Island, a barrier island in Northampton Co., Virginia (Barry Truitt, pers. comm.). Only one individual was reported and it has not been found since, despite repeated surveys (Barry Truitt, pers. comm.). In addition, Clovis in his study on the vegetation of Smith Island (1968) did not list *Q. virginiana* as being observed. In 2008, a population of live oak was discovered in southern Northampton Co., Virginia, on the Chesapeake Bay side of the Peninsula. Sixty-two individuals were counted, scattered along a 0.5 mile (0.8 km.) stretch of beach. Plants were growing behind the primary dune at the face of a maritime forest dominated by *Pinus taeda*. Individuals ranged in size from one foot (0.3 m.), to 8 feet (2.4 m.) in height and were clearly affected by salt spray and wind. The overall geographic distribution of *Q. virginiana* is from southeast Virginia to southern Florida and west to Texas (Weakley 2010). The northernmost occurrence of live oak in the eastern USA appears to be in Mathews Co., Virginia (V.B.A. 2010), which is west of Northampton Co. and north of Kiptopeke.

Voucher specimen. **VIRGINIA. Northampton Co.**: South of Kiptopeke and Sunset Beach, Eastern Shore of Virginia NWR, west of Rt. 13, north of Bay Bridge toll, 30 Aug 2008, *McAvoy 6435* (DOV).

GELSEMIACEAE

***Gelsemium sempervirens* (L.) St. Hilaire**

Gelsemium sempervirens was thought to have been documented first on the Eastern Shore of Virginia by Fernald in 1935 from Northampton Co., Virginia ["moist sandy woods back of dunes, Savage Neck," 15 October 1935, *Fernald, Long & Fogg 5411*, PH; (R. Tatnall 1946)], but this specimen was determined to be *Trachelospermum difforme* (Walt.) A. Gray by W.A. McAvoy (23 January 1999). The first documentation of *G. sempervirens* from the Eastern Shore of Virginia was made by McAvoy (*4257* DOV) in 1998 and again in 1999 (*4534* DOV). However, McAvoy made the same mistake that Fernald did and labeled both of these collections as *T. difforme*. The impetus for McAvoy to reexamine his collections that were thought to be *T. difforme* was from the discovery of a population of *G. sempervirens* in Kiptopeke State Park in Northampton Co. by Wes Knapp and Chris Frye in 2005 (*1144* DOV). McAvoy and Knapp later confirmed the identity of this population in 2006 as *G. sempervirens* (*6208* DOV). On the same day, the pair then revisited the site where McAvoy collected *T. difforme* in 1999 (*4534* DOV); this visit determined the population to be *G. sempervirens*. The overall geographic distribution of *G. sempervirens* is from southeast Virginia to Tennessee and Arkansas, south to Florida and Mexico (Gleason & Cronquist 1991). The northernmost occurrence of *G. sempervirens* in the eastern USA appears to be in Lancaster Co., Virginia (V. B. A. 2010).

Voucher specimens. **VIRGINIA. Northampton Co.**: In young pine woods around abandoned sandpit, east of Rd. 600 and east of Kendall Grove, 25 Jul 1998, *McAvoy 4257* (DOV); Abundant in canopy gaps, woods on north side of Rd. 646, south of Cheapside, 26 Aug 1999, *McAvoy 4534* (DOV); Kiptopeke St. Park, many immature plants on ground around trees and twining high in trees, 21 Apr 2005, *Knapp 1144 & Frye* (DOV); Several robust plants climbing high to the top of trees with thick twining stems, many immature plants on ground around trees, Kiptopeke St. Park, south side of entrance road in moist sandy oak/pine woods, 4 Dec 2006, *McAvoy 6208 & Knapp* (DOV).

IRIDACEAE

***Sisyrinchium arenicola* Bickn.**

[*Sisyrinchium fuscatum* E.P. Bicknell]

This report is a putative rediscovery of the species in Maryland. Moldenke (1945) reported this plant from Worcester County, Maryland, but the report has never been substantiated with a specimen. Sorrie and Weakley (2001) included *S. arenicola* E.P. Bickn. (senso stricto) as a northeastern endemic occurring from southeastern Massachusetts to southern New Jersey and adjacent Delmarva Peninsula. *Sisyrinchium arenicola* occurs as a widely dispersed, rare forb of sandy openings in a dry pine-oak-heath natural community at a single location in Maryland.

Voucher specimen. **MARYLAND. Caroline Co.**: in open dry sands north of Houston Branch, 30 May 2007, *Frye 5530* (TAWES, DOV).

JUNCACEAE

***Juncus articulatus* L.**

This is the first documentation of this species from the Coastal Plain physiographic province of Maryland. This is only the second extant population known to occur in the state of Maryland with the other being on the Alleghany Plateau physiographic province in Garret County. Predominantly a northern species, *J. articulatus* is known from the Coastal Plain in the southern portion of its range. The species was first reported from the New Jersey Coastal Plain by Stone (1911) from "along the edge of the salt marsh on the costal islands and the mainland" but is now considered historic. The habitat on Assateague Island where this species was discovered is similar to Stone's description from New Jersey and should be sought there.

Voucher specimen. **MARYLAND. Worcester Co.**: Assateague Island., Inner-dunal swale at North Beach Campground, S. of camp shower, 14 Oct 2008, *Knapp 2638* (Assateague Island National Seashore Herbarium).

Juncus elliottii* Chapman var. *elliottii

This report represents a new record for the Eastern Shore of Maryland. *Juncus elliottii* is considered historic in Delaware where it was collected by Bayard Long in 1908 (*s.n.* PH). This is a southern species near the northern limit of its range. *Juncus elliottii* is found from New Jersey, south to Florida and west to Louisiana (Brooks & Clements 2000) though not including Maryland. This species occurs in disturbed and acidic sandy seeps in very small numbers and is associated with an abundance of other regionally and state species of concern. It could overlooked due its similarity to *J. acuminatus*.

Voucher specimen. **MARYLAND. Wicomico Co.**: Ca. 12 km SE of Salisbury and ca. 4 km SE the int. of Fooks Road with Airport Road, 26 Jun 2009, *Knapp 2867* (TAWES).

***Juncus megacephalus* M.A. Curtis**

Though this species is attributed to Maryland by Redmond in his "Flora of Worcester County" (1932), no other treatment includes this species to Maryland (i.e. Brooks & Clements 2000; Gleason & Cronquist 1991). Various herbaria have been searched in hopes of locating a specimen validating this report (BALT, DOV, MARY, NA, NY, PENN, PH, US) yet no specimen can be found. Fernald (1950) presumably suspected this identification was incorrect and stated "doubtfully to se. Maryland". This report marks the northern limit of the species range. Given the habitat in which the species was discovered (wet sands in State Park of Assateague Island State Park), it is doubtful that this conspicuous rush was overlooked by previous researchers but instead may be expanding its range to the north.

Voucher specimen. **MARYLAND. Worcester Co.**: Assateague Island., Inner-dunal swale at North Beach Campground, S. of camp shower, 14 Oct 2008, *Knapp 2637* (Assateague Island National Seashore Herbarium).

Juncus validus* Coville var. *validus

These collections mark the first reports of this species from Delaware and the Eastern Shore of Maryland and document what appears to be a relatively rapid expansion of the species northward. *Juncus validus* was first collected in Harford Co., Maryland, by E. Baltars in 1965 (Strong & Simmons 2000) but has since been documented from Anne Arundel (*Smith s.n.* TAWES), Cecil (*Davis s.n* TAWES) and Prince George counties (*Strong & Simmons 1970* US). In 2005 and 2006, three populations of this were discovered in Delaware and on Maryland's Eastern Shore, all located in or along heavily disturbed roads. The putative native range of *J. validus* is North Carolina south to

Florida west to Texas, southwest Missouri and Oklahoma (Brooks & Clements 2000). *Juncus validus* is considered non-native in the northern extreme of its range in Virginia, Maryland, and Delaware.

Voucher specimens. **DELAWARE. Sussex Co.**: Bethany Beach along DE Rt. 1 about 0.5 mi. N of Fred Hudson Rd. (360), on the W side of the road, 2 Jul 2006, *Longbottom* 7586 (DOV) **MARYLAND. Dorchester Co.**: East of North Tara Road, growing in abandoned logging road, seasonally inundated, 26 Aug 2006, *Knapp 2002* & *Longbottom* (DOV). **Wicomico Co.**: North and South of Rt. 313, 1.1 km west the town of Mardela Springs, 27 Jul 2005, *Knapp 1550* (DOV, TAWES).

LENTIBULARIACEAE

***Utricularia cornuta* Michaux**

Utricularia cornuta was last collected in Maryland by Hotchkiss & Leonard (*21298* US) in 1960 from the Coastal Plain of Maryland in Anne Arundel County. Community classification surveys in Allegany Plateau wetlands in Garrett County resulted in the rediscovery of this species in Maryland. *Utricularia cornuta* is found from Newfoundland and Quebec west to N. Ontario, Alberta, and Minnestora, south to southern Florida, and eastern Texas (Weakley 2010)

Voucher specimen. **MARYLAND. Garrett Co.**: Town of McHenry, Rock Lodge Trust, 0.5 mi S of Rock Lodge Ln. and Rock Lodge Rd int., growing in an open acidic seepage peaty fen throughout shallow muck hollows, and low peat hummocks frequent, 21 Jul 2010, *Stango 2010132-1 et al.* (TAWES).

MALVACEAE

***Modiola caroliniana* (L.) G. Don**

This collections marks the first documentation of this species in Maryland. Known from Virginia, Delaware, and Pennsylvania (USDA Plants Database 2010), this species was conspicuously absent from the Maryland flora. It is believed not to be native in the northern portion of its range in Delaware. Nor is the Maryland population likely native, because it was found growing in a mowed lawn on sandy soil.

Voucher specimen. **MARYLAND. Montgomery Co.**: Naval Surface Warfare Center, Carderock Division Center, mowed lawn on sandy soil near woodland edge, 13 Jun 1996, *Davis 7241* (Herb. Patuxent Naval Air Station).

MELIANTHIACEAE

***Stenanthium leimanthoides* (Gray) Zomlefer & Judd**

[Zigadenus leimanthoides A. Gray]

The discovery of this species marks an addition to the flora of Maryland. In the northeast, this species is distributed along the Coastal Plain and is historically known in New York and Delaware and is known from fewer than 5 populations in New Jersey. The species then ranges from the mountains of West Virginia and Virginia before becoming widespread in the southeastern USA. This Maryland occurrence is located along the fall-line just 6.8 km from Pennsylvania and 11 km from Delaware. Brown and Brown (1984) reported this species as "infrequent," being "a coastal species, found in the mountains of Maryland". Brown and Brown's report is erroneous — no other literature source includes this species as a component of the Maryland flora and no herbarium is known to contain a specimen of this species from Maryland.

Voucher specimens. **MARYLAND. Cecil Co.**: Northeast the town of Belvedere 0.8 km and located between I-95 and Route 40, Plants growing in huge fresh water seepage underlain by terraced gravel deposits, 4 Aug 2009, *Knapp 2968 et al.* (US & FLAS).

ONAGRACEAE

Ludwigia glandulosa* Walter subsp. *glandulosa

These collections represent a rediscovery for this species in Maryland since its initial collection by Holmes from Somerset Co. in 1890 (Peng 1989). This species was reported by Rome in 1987 (Maryland Natural Heritage Program Database), but a voucher specimen was not made and the report was never confirmed. Though attempts by area botanists were made in subsequent years to document and confirm this species, the population was never located and is believed extirpated due to roadside ditch maintenance (F. Hirst, pers. comm.). This collection verifies Rome's report and documents the northern limit of the species range. The overall geographic distribution is southeastern Virginia, south to Florida and Texas, and north in the interior to southern Indiana and Kansas (Gleason & Cronquist 1991).

Voucher specimens. **MARYLAND. Somerset Co.**: Northwest side of Route 413 ca. 0.4 km west the int. of Lovers Lane, 22 Jul 2003, *Knapp 58-03* (DOV); Roadside ditch north side of Fairmont Rd (Rt. 361), at int. of Hood Rd., 23 Aug 2006, *Knapp 2029* (DOV).

***Ludwigia leptocarpa* (Nutt.) Hara.**

Ludwigia leptocarpa was first collected in Wicomico Co., Maryland, by John Dennis in 1996 (McAvoy 2000), from a small population along a power-line through an emergent tidal marsh. At that time, the species was considered native (McAvoy 2000), but a new discovery of the species from Sussex Co., Delaware, has resulted in a reevaluation of its status. In 2005, this species was discovered growing in a freshwater impoundment at Prime Hook National Wildlife Refuge (NWR) and was a new addition to the flora of Delaware. Since its discovery here, surveys have found this species to be dominating perhaps over 500 acres of impounded marshland. This species is clearly invasive at this site and was likely established by waterfowl as they migrate along the eastern flyway. Land managers working along the East Coast should be alert to this species. Control efforts have begun at Prime Hook NWR by refuge staff with the hopes of eventually eradicating it. The overall geographic distribution of *L. leptocarpa* is from Virginia, south to Florida and west to Texas, and in the interior to southeast Missouri and southern Illinois (Gleason & Cronquist 1991). *Ludwigia leptocarpa* is now considered to be adventive in Delaware.

Voucher specimen. **DELAWARE. Sussex Co.**: Forming a monoculture over many acres, fresh water impoundment marsh, south side of Broadkill Rd., just west of Broadkill Beach, Prime Hook NWR, 9 Sep 2005, *McAvoy 6135* (DOV).

ORCHIDACEAE

***Platanthera peramoena* (Gray) Gray**

The collection cited below documents a new and rare Coastal Plain occurrence for the species. *Platanthera peramoena* is primarily a plant of the Mountain and Piedmont provinces of the eastern USA [central Pennsylvania and Ohio, south to Alabama, west to eastern Arkansas and eastern Missouri (Luer 1975, Weakley 2010)]. On the Coastal Plain this species is quite rare and is extant in only one county in southern New Jersey [Monmouth Co. (pers. comm. David Snyder)] and in three counties in southeast Virginia [Greensville, Lancaster, and Northumberland (V.B.A. 2010)]. Four flowering, robust individuals were discovered in an isolated, forested wetland of high ecological quality, which also included *Ranunculus septentrionalis* Poir. as an associate (see discussion below).

This population occurs about five miles south of the fall-line in south-central New Castle Co., Delaware.

Voucher specimen. **DELAWARE. New Castle Co.**: South of Glasgow, seasonally flooded forested wetland with a thin canopy of: *Acer rubrum*, *Fraxinus pensylvanica* and *Quercus bicolor*, 21 Jul 2010, *McAvoy 6819* (DOV).

***Platanthera shriveri* P.M. Brown**

[not in PLANTS DATABASE]

This southern Appalachian endemic was newly described by Brown et al. (2008). In Brown's publication, populations were noted from states adjacent to Maryland (West Virginia, Virginia, and Pennsylvania) but not from Maryland itself. Photographs of the plants were sent to P.M. Brown, who confirmed their identity.

Voucher specimen. **MARYLAND. Frederick Co.**: Northwest the town of Frederick in the City of Frederick Municipal Forest, along stream, 14 Jul 2009, *Knapp 2891 & Wiegand* (TAWES).

PHRYMACEAE

***Glossostigma cleistanthum* W.R. Barker**

[*Glossostigma diandrum* (L.) Kunze]

The specimens cited below are the first collections from Maryland and Delaware, where they were collected from deep storm-water retention ponds. This species is native to Australia and was first reported in North America by Les et al. (2006). The known distribution of this species before these collections was Connecticut, New Jersey, Pennsylvania, and Rhode Island.

Voucher specimens. **DELAWARE. Sussex Co.**: Rehoboth Beach along Postal Road 0.25 mi west of DR Rt. 1, sediment control pond, 23 Aug 2008, *Longbottom 12,508* (DOV). **MARYLAND. Wicomico Co.**: Town of Salisbury. NE the int of Northwood Drive and Kiley Drive in draw-down zone of sediment control pond, 13 Aug 2008, *Longbottom 12,000* (DOV).

PHYLLANTHACEAE

Phyllanthus caroliniensis* Walt. subsp. *caroliniensis

Tatnall (1946) stated that *Phyllanthus caroliniensis* was infrequent on the Coastal Plain and was first collected near Snow Hill, Maryland, in 1863 (*W.M. Canby s.n.* PH). The Maryland collection cited below is an apparent rediscovery to the Eastern Shore of Maryland. While doing herbarium research related to this paper, specimens from Sussex Co., Delaware, were discovered representing a previously undocumented component of the Delaware Flora. This species was believed historic in Delaware until it was rediscovered in 2011.

Voucher specimens. **DELAWARE. Sussex Co.**: Laurel, 4 Aug 1874, *Commons s.n* (DOV, NA);. town of Ellendale, Redden State Forest Barr Tract, along DE Rt 16, near Webbs Road, along dirt road, 4 Sep 2011, *Longbottom 16004 & Pengelly* (NY, MO). **MARYLAND. Wicomico Co.**: south side of Twiley Bridge Road at int. of Fooks Road, under power line Right-of-way, growing in disturbed seasonally inundated sandy soils, 13 Sep 2005, *Knapp 1685* (DOV)

POACEAE

***Axonopus furcatus* (Fluegge) A. Hitchc.**

The collections cited below represent a northern range extension for the species and the collections from Worcester Co., Maryland, is a rediscovery of a historical species to the Maryland flora. *Axonopus furcatus* is a species endemic to the southeastern United States and ranges from southeastern Virginia to Florida, west to Texas and Arkansas (Barkworth 2003). Before its rediscovery in 2005, this species was considered historic in Maryland and was known from only a single collection made by Rusby in 1889 (*s.n.* NY) from the town of Stockton in Worcester County, Maryland. The 2005 collection was made approximately 17 km north of Stockton where Rusby made his collection in 1889. A collection from Somerset Co., Maryland, calls into question the nativity of the species in Maryland. This collection was made along a roadside supporting a population approximately 7 km in length with too many individuals to accurately assess. This species is also historically known from Northampton Co., Virginia (*Fernald 5207* et al. PH).

Voucher specimens. **MARYLAND. Somerset Co.**: North and south of Rt. 413 between Princess Anne and Crisfield, commonly distributed along grassy mowed roadsides, 23 Aug 2005 *Knapp 2024* (DOV). **Worcester Co.**: South side of Forest Lane Road ca. 1700 feet east from the int. of Voting House Road, 22 Aug 2004, *McAvoy 6087 et al.* (DOV) & 6 Oct 2004, *Knapp 1106 et al.* (TAWES); East side of Mount Olive Church Road, 0.3 mi. N of int. of Glatfelter Logging Road, 19 Sep 2006, *Knapp 2084 & Naczi* (DOV).

***Elymus macgregorii* R. Brooks & J.J.N. Campbell**

[not in PLANTS DATABASE]

Elymus macgregorii is new to the flora of Delaware. The previously known range is quite wide: Maine to North Dakota, south to Florida and Texas (Campbell 2000; Barkworth et al. 2007). This species is undoubtedly native to Delaware, given its known distribution and ecology and the nature of the particular site in which it occurs in Delaware. The Delaware population of *E. macgregorii* occurred in a moist, shaded understory of a mature, high-quality deciduous forest on the floodplain of the Brandywine Creek. It was infrequent at the site.

This grass is a recently described species (Campbell 2000). In addition to its morphology, the voucher cited below fits Campbell's description of fruiting relatively early (compared to other eastern North American *Elymus* species) and inhabiting nutrient-rich alluvium.

Voucher specimen. **DELAWARE. New Castle Co.**: N of Rockland, 29 Jun 1984, *Naczi 545 & Seyfried* (DOV), determined by Julian J.N. Campbell, Feb 2006.

***Muhlenbergia uniflora* (Muhl.) Fern.**

This collection marks a rediscovery of the species in Maryland. This species was first collected by F.H. Sargent in 1953 (*6369* US) from Suitland Bog (Prince Georges Co.), a well botanized Magnolia Bog. It is curious that this species was undocumented from this site for 72 years given the distinctness of the species, the frequency that the area has been botanized, and the size of the population (50+ individuals). *Muhlenbergia uniflora* ranges from Newfoundland, west to Ontario and northern Michigan, and south to New Jersey (Gleason & Cronquist 1991).

Suitland Bog has a history of plant introductions (see discussion under *Rhynchospora rariflora*), such as *Sarracenia purpurea* and *Drosera filiformis* (M. Strong pers. com.). *Muhlenbergia uniflora* is either a rare component of the Maryland flora at the extreme southern limit of its native range, or else it is a rare introduction.

Voucher Specimens. **MARYLAND. Prince George Co.**: Suitland Bog, small open headwater seepage area, on sole isolated tussock, 1200 ft. N the int. of Suitland Rd. and Suitland Parkway, 18 Jul 2007, *Knapp 2319 et al.* (US).

***Parapholis incurva* C.E. Hubbard**

This represents the first published reports of this non-native species from Maryland's Eastern Shore and to the Flora of Delaware. The species was first collected from Sussex Co., Delaware, by Agnes Chase from Sussex Co. in 1916 (*2283* US), yet no source attributes the species to Delaware (e.g., McAvoy 2001; Tatnall 1946). *Parapholis incurva* is native to Europe and has been documented along muddy shores and marshes from both the Atlantic and Pacific Coasts of the USA (Gleason & Cronquist 1991).

Voucher specimens. **DELAWARE. Sussex Co.**: Wet sands, Lewes, 12 Jun 1916, *Chase s.n.* (DOV). **MARYLAND. Somerset Co.**: N of Rt. 413 and ca. 2.4 km north of the town of Crisfield at Janes Island State Park. Growing in disturbed marsh edge, 200 feet from softball field. 26 May 2005, *Knapp 1201* (DOV). Deal Island Wildlife Management Area, Southwest the town of Dames Quarter ca. 1.0 km, 31 May 2006, *Knapp 1907* (DOV).

***Puccinellia fasciculata* (Torr.) Bickn**

Before its rediscovery, this species was believed to be historical in Maryland, having last been collected by Terrell and Uhler (*4918* MARY) in 1978 from Dorchester County, Maryland. This discovery, also in Dorchester County, was found in a fresh-tidal portion of the Chicamacomico River, under a power-line right-of-way. Recent work has determined that the species is not indigenous to North America (Davis & Consaul 2007).

Voucher specimen. **MARYLAND. Dorchester Co.**: North of New Bridge Road, west the town of New Bridge, west the int. of New Bridge Road and the Chicamacomico River ca. 50 feet, 26 Mar 2006, *Knapp 1884* (DOV).

PORTULACACEAE

***Montia linearis* (Dougl. ex Hook.) Greene**

This species, considered to be adventive in Maryland, was first collected in Prince George's Co., by Hershkovitz (1999). These collections mark the first documentation from Maryland's Eastern Shore. Native to the northwestern USA, *Montia linearis* has shown a rapid expansion of its range over the past 10 or more years, having been documented in many states east of the Mississippi River (Hershkovitz 1999). States where documented include: Mississippi, North Carolina, Tennessee, and Virginia (Chester, et al. 1997; Weakley 2010). This species could be expected to occur in neighboring states but given the phenology of the species (flowering March and fruiting in April) and the habitat (fallow fields and roadsides), it could be overlooked.

Voucher specimens. **MARYLAND. Caroline Co.**: Fallow agricultural field, southeast the town of Henderson, west of Jackson Lane, 3 May 2006, *Knapp 1872 & Wilson* (DOV). **Dorchester Co.**: Open agricultural field at edge of rich woods, ca. 3.5 km WNW of Vienna, 1 May 2009, *Knapp 2672* (DOV).

PRIMULACEAE

***Lysimachia japonica* Thunb.**

The specimen cited below marks an addition to the flora of Maryland. This species occurs naturally in China and Japan (Cholewa 2009). The North American range of this species as reported by Cholewa (2009) is only Louisiana and West Virginia. This species was discovered along a roadside adjacent to an abandoned field of young pole-sized trees and it is likely to be discovered in many other locations.

Voucher specimen. **MARYLAND. Montgomery Co.**: E side of Wayfarar Rd., S of bend N or Watkins Meadow Drive, Germantown, 22 Jul 2005, *Davis 7243A* (BALT).

RANUNCULACEAE

***Ranunculus laxicaulis* (Torr. & Gray) Darby**

Before its rediscovery in 2006, this species was last documented in Maryland by R. Tatnall on 2 June1939 (*3391* PH). The location cited below is believed to be identical to Tatnall's collection site. The habitat supporting this species (exposed muddy tidal shores along tributaries of the Pocomoke River, under a canopy of *Taxodium distichum* (L.) Rich.) is widespread in the area and more exhaustive surveys could uncover additional populations.

Voucher specimen. **MARYLAND. Worcester Co.**, Exposed muddy banks of Purnell Branch, 0.5 km northeast from int. of Rt. 113 and Rt. 365, 8 Jun 2006, *Knapp 1939* (TAWES).

***Ranunculus septentrionalis* Poir.**

[*Ranunculus hispidus* Michx. var. *nitidus* (Chapman) Duncan]

This report is a new addition to the flora of Delaware. Tatnall (1946) listed *Ranunculus septentrionalis* for Delaware but misapplied this name to *R. caricetorum* Greene [*R. hispidus* Michx. *var. caricetorum* (Greene) Duncan], a rare species of Delaware's Piedmont province. *Ranunculus septentrionalis* was first collected on the Coastal Plain in Kent Co., Delaware, in 2007 and then again in 2010 from New Castle Co., Delaware, also on the Coastal Plain (see discussion above for *Platanthera peramoena*). *Ranunculus septentrionalis* ranges from New York, west to Ontario, south to east Texas, Louisiana and Florida (Weakley 2010). On the Coastal Plain, it is known from New Jersey (Stone 1911), Virginia, North and South Carolina, Georgia, and Florida (Weakley 2010).

Voucher specimens. **DELAWARE. Kent Co.**: Several plants found growing on nutrient rich bottomland soils on floodplain of stream, with skunk cabbage, tributary of the Leipsic River, south of Smyrna, sepals strongly reflexed, achene margin 1 mm broad, 3 May 2007, *McAvoy 6217* (DOV); same site, 13 Jun, *McAvoy 6232* (DOV). **New Castle Co.**: South of Glasgow, 10 plants in a localized area of a forested wetland with a thin canopy of: *Acer rubrum, Fraxinus pensylvanica* and *Quercus bicolor*, site is seasonally flooded, 21 Jul 2010, *McAvoy 6821* (DOV).

RHAMNACEAE

***Rhamnus alnifolia* L'Héritier**

Until 2009, this species was noticeably absent from the flora of Maryland yet known from the neighboring states of West Virginia and Pennsylvania (the neighboring location in Pennsylvania is now historic). This species is found from Newfoundland, west to British Columbia, south to New Jersey, Pennsylvanica and West Virginia, Virginia, and Tennessee, Ohio, and throughout the Midwest into California (Weakley 2010).

Voucher specimen. **MARYLAND. Garrett Co.**: The Glades. Approximately 2.7 km west of Cunningham Swamp and 1.3 km S of the Glade Church, 21 Jul 2009, *McPherson s.n.* (TAWES).

ROSACEAE

***Amelanchier nantucketensis* Bickn.**

Ashe (1919) first described this taxon as *A. micropetala* (Robinson) Ashe from the area around Great Falls, Maryland. Dibble & Campbell (1995) later synonymized *A. micropetala* with *A. nantucketensis*. The Maryland record never appeared in regional floristic manuals (e.g. Fernald

1950). Taxonomic uncertainty regarding the occurrence in Maryland remained until surveys for the species were undertaken in 2001. *Amelanchier nantucketensis* occurs frequently along the Potomac River Gorge in Maryland and Fairfax Co., Virginia (V.B.A. 2010) and is a wide disjunct from the core of its range in New England.

Voucher specimens. **MARYLAND. Montgomery Co.**: outcrops and cliff ledges along the Potomac River, 16 Apr 2002 (flowers), 13 Jun 2002 (mature leaves, fruit), *Frye 5027* & *Harrison* (TAWES, MAINE).

***Rubus bifrons* Vest ex Tratt.**

Rubus bifrons is native to Europe and has become increasingly widespread in the USA. Though this is the first report of this species from Maryland its discovery is not unexpected. Currently, *R. bifrons* has been documented in neighboring Pennsylvania (Rhodes & Klein 1993) and Virginia (V.B.A. 2010). The overall geographic distribution of this species is Massachusetts and New York, south to Georgia and west to Texas.

Voucher specimen: **MARYLAND. St. Mary's Co.**: Patuxent River Naval Air Station, woods edge N of Building 503, 26 May 2000, *Davis 7251* (Herbarium of the Patuxent River Naval Air Station).

RUBIACEAE

***Houstonia pusilla* Schöpf**

Houstonia pusilla is native to the southeastern and midwestern USA (Terrell 1996). The northeasternmost previously known populations, in the northeastern portion of the Western Shore of Maryland, are probably non-native, evidenced by the recentness of their discoveries and their presence in "weedy places" (Terrell 1996). Otherwise, the northern limit of the species in the eastern USA is central Virginia (Terrell 1996).

The collections cited below are apparently the first from Delaware, the Eastern Shore of Maryland, and the Eastern Shore of Virginia. Local resident James B. McClements discovered the Kent County, Delaware, population a few years before the collection cited below. Subsequent to this discovery it has been documented in all Delaware counties, 6 from the Eastern Shore of Maryland and in Accomack County, Virginia. It is apparently established in the flora.

We suspect that *Houstonia pusilla* is not native to Delaware, the Eastern Shore of Maryland, or the Eastern Shore of Virginia for the same reasons as cited for the Western Shore of Maryland populations. However, given the propensity of this species to grow in disturbed sites, the proximity of native populations to these areas, and the continued discovery of state records of native species, we cannot rule out the possibility that the species is native. In this uncertainty, *H. pusilla* is similar to *Planodes virginicum*.

Voucher specimens. **DELAWARE. Kent Co.**: Dover, along E side of Kenton Road, 7 Apr 2006, *Naczi 11329 et al.* (NY). **New Castle Co.**: 100's of flowering plants scattered throughout mowed lawn, Old Drawyer's Church cemetery, west of Rt. 13, just N of Odessa, 5 Apr 2007, *McAvoy 6210* (DOV). **Sussex Co.**: Town of Harbeson along Rt. 9, 1 Apr 2011, *Longbottom 14680* (NY); **MARYLAND. Caroline Co.**: Town of Federalsburg along MD 318, 28 May 2007, *Longbottom 8359* (NY). **Dorchester Co**: Town of Cambridge, Aireys Road spur off Rt. 50, 6 Apr 2011, *Longbottom 14717* (NY); **Queen Anne's Co.**: Wye Island Rd W of Carmichael Rd, 12 Apr 2011, *Longbottom 14736* (NY); **Talbot Co.**: N the town of Easton, Woodlawn Memorial Park, 11 Apr 2011, *Longbottom 14734* (NY); **Wicomico Co.**: Town of Hebron, Rt. 50 at Springhill Memorial

Gardens, 8 Apr 2011, *Longbottom 14723* (NY); **Worcester Co.**: Town of Snow Hill along US 113, at the entrance of Pocomoke River State Park, Shad Landing, 1 Apr 2011, *Longbottom 14681* (NY). **VIRGINIA. Accomack Co.**: N of Mappsville, Rt. 13, at State Road 691, 3 Apr 2011, *Longbottom 14696* (NY).

ZYGOPHYLLACEAE

***Tribulus terrestris* L.**

This species was first attributed to Maryland by Reed (1964) from chrome and manganese ore piles and was best treated as a waif. A native of Mediterranean Europe (Weakley 2010), it is found in most states in the eastern USA with the exception of the New England states, Virginia, and West Virginia. These plants were found in ruderal habitats along corn fields and should be sought in similar habitats across the Region. The species is now an established component of the flora.

Voucher specimen. **MARYLAND. Wicomico Co.**: West the town of Quantico at Nutters Neck Wildlife Management Area at end of Nutters Neck Road, 9 Sep 2007, *Longbottom 10468 & Van Velsir* (DOV).

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STUDIES OF NEOTROPICAL COMPOSITAE–III. *DICHROCEPHALA INTEGRIFOLIA* (ASTEREAE: GRANGEINAE) IN GUATEMALA, AN EXOTIC GENUS AND SPECIES NEW TO THE AMERICAS

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ABSTRACT

Dichrocephala integrifolia is documented, based on three recent collections from Guatemala, as a genus and species new to the Americas. Genera of Astereae subtribe Grangeinae known in the Americas include *Egletes*, *Plagiocheilus,* and now *Dichrocephala*.

KEY WORDS: America, Asteraceae, Astereae, Central America, Compositae, Cuchumatanes, *Dichrocephala*, Grangeinae, Guatemala, Huehuetenango, Mesoamerica, Neotropics.

The genus *Dichrocephala* L'Hér. ex DC. (Compositae: Astereae: Grangeinae) was revised by Fayed (1979), who recognized four species, but Beentje (2002) recognized only three species. *Dichrocephala* was placed in Astereae subtribe Grangeinae Benth. & Hook. f. by Fayed (1979), Bremer (1994), Nesom (1994), and Nesom and Robinson (2007). Nesom and Robinson (2007) recognized 16 genera within the Old World-centered Grangeinae. Characters useful in recognizing Grangeinae are the often disciform capitula with marginal pistillate florets usually pluriseriate and with white corollas, phyllaries never prominently resinous-veined, epaleate receptacles usually convex to conical, papillose triangular style branch appendages, and compressed erostrate cypselae often (at least in the Americas) epappose or nearly so. Among American Grangeinae, *Dichrocephala* is diagnosed by disciform (vs. radiate or pseudobilabiate) capitula.

Nesom (2000) gave *Egletes* Cass. and *Centipeda* Lour. as the only American genera of subtribe Grangeinae, but Panero (2007) modified this by treating *Centipeda* as the only genus of the African-centered tribe Athroismeae present in the Americas. Robinson and Brettell (1973) transferred South American *Plagiocheilus* Arn. ex DC. from tribe Anthemideae to tribe Astereae. Nesom (1994) and Nesom and Robinson (2007) treated *Plagiocheilus* within subtribe Grangeinae, and *Egletes* and *Plagiocheilus* as the only genera of Grangeinae occurring in the Americas. Grau (1977) noted that within tribe Grangeinae, *Dichrocephala* and *Grangea* Adans. are noteworthy for occurring in both Africa and Asia. Fayed (1979) gave *D. integrifolia* as occurring in Africa, Asia, and the western Pacific region, with the species appearing to be introduced into Australia (e.g., Stanley & Ross 1986) and Europe (e.g., Davis & Grierson 1975; Tutin et al. 1976; Clement & Foster 1994).

Work preliminary to a treatment of Compositae for Flora Mesoamericana shows that *Dichrocephala integrifolia* has apparently become established in Guatemala. This new generic continental report is based on three recent collections (in two localities) of *D. integrifolia* made in Guatemala. The genus appears not to have been reported previously in the Americas, and it is not listed as occurring in the Americas in Bremer (1994), Cuatrecasas (1986), Dillon (2005), Fayed (1979), Nash (1976), Nesom (1994), Nesom (2000), or Nesom and Robinson (2007).

In Guatemala, *Dichrocephala integrifolia* appears to be restricted to the Atlantic watershed, a distribution which when combined with the prevailing trade winds coming from the east and closer proximity of Guatemala to Africa than to Asia, suggests that the species could have been introduced into the Americas from Africa. If this is indeed the case, we should expect *D. integrifolia* to

ultimately be found in the West Indies, as are other moderately uncommon alien Compositae [e.g., *Crassocephalum crepidioides* (Benth.) S. Moore and *Sclerocarpus africanus* Jacq.] that are presumed to have been introduced into the Neotropics from Africa. It should be noted, however, that in reporting *Adenocaulon* (Compositae: Mutisieae) as a genus new to Guatemala, Blake (1934) drew attention to its previously known distribution in only northern and western temperate North America, southwestern South America, and eastern Asia, suggesting possible long-distance dispersal to Guatemala from Asia. It is unknown whether *D. integrifolia* was introduced into the Americas from Africa or Asia or whether its introduction is the result anthropomorphic influences.

The purpose of this report is to document *Dichrocephala integrifolia* (Asteraeae: Grangeinae) as a genus and species new to the Americas, to provide a key (modified from that of Grierson & Springate 2001) to species of *Dichrocephala*, to give brief synonymy of *D. integrifolia*, and to provide generic and specific descriptions of it that may be inserted into the Guatemalan Astereae treatment by Nash (1976). In that treatment *D. integrifolia* would key closest to *Egletes* by its annual habit, tall receptacles, and usually lyrate-pinnatifid leaves.

DICHROCEPHALA L'Hér. ex DC.

Annual herbs, monoecious; stems leafy; herbage never stipitate-glandular. **Leaves** simple to often lyrate-pinnatilobed or lyrate-pinnatifid, alternate, sessile or petiolate; blade thinly chartaceous, venation pinnate, base sometimes subauriculate. **Capitulescence** in open cymes, racemes, or panicles, rarely monocephalous. **Capitula** small, globose, disciform; involucre campanulate or hemispherical to crateriform; phyllaries imbricate, subequal, ca. 2-seriate, without prominent resinous veins; receptacle convex to conical or obovoid, epaleate, sometimes enlarged in fruit. **Marginal florets** many-numerous, pluriseriate, pistillate; corolla tubular to nearly salverform (never pseudobilabiate), sometimes bulbous proximally, sparsely glandular, apex 2–3(–4)-denticulate. **Disk florets** fewer in number than marginal florets, bisexual; corolla campanulate or sometimes salverform, 4(–5)-lobed, lobes usually ascending to erect; anthers ecaudate, obtuse to sagittate basally, apical appendage broadly triangular; pollen echinate, tricolporate, non-lophate with tectum continuous; style branch stigmatic surfaces 2-banded proximally, sterile apical appendage triangular, shorter than to about as long as fertile portion. **Cypselae** isomorphic, obovate, compressed, erostrate, green maturing pale brown, glandular usually at least apically and/or basally, otherwise glabrous, margins thickly costate, faces smooth or less typically indistinctly 1–2-striatulate, fruit sometimes shortly stipitate-pedicellate; pappus absent or disks sometimes with 1–2(–few) short caducous smooth bristles. $x = 9$. 3 spp. Native to Africa, Asia, and western Pacific region; introduced into Australia, Europe, and now Guatemala.

Key to the species of *Dichrocephala*

1. Capitula usually 6–8 mm diam.; phyllaries pilosulose to pilose; marginal pistillate florets with corollas funnelform to nearly salverform ..... **Dichrocephala chrysanthemifolia**
1. Capitula 2–4 mm diam.; phyllaries glabrous or subglabrous; marginal pistillate florets with corollas tubular to urceolate.
   2. Herbs to 0.35 m tall; marginal pistillate florets with corollas ovoid or urceolate; leaves sessile, usually pinnatilobed ..... **Dichrocephala benthamii**
   2. Herbs to 0.8(–1.3) m tall; marginal pistillate florets with corollas tubular, cylindrical throughout; leaves usually petiolate, usually lyrate-pinnatifid ..... **Dichrocephala integrifolia**

DICHROCEPHALA INTEGRIFOLIA (L. f.) Kuntze, Revis. Gen. Pl. 1: 333. 1891. *Hippia integrifolia* L. f., Suppl. Pl. 389. 1781. **LECTOTYPE** (designated by Fayed 1979: 494): **INDIA.** *Anon. s.n.* (LINN-1039.1, IDC microfiche 177. 626.III.4).

Centipeda latifolia Cass. ex Less., *Cotula bicolor* Roth, *Cotula latifolia* Pers., *Dichrocephala bicolor* (Roth) Schltdl., *Dichrocephala latifolia* DC., *Ethulia integrifolia* (L. f.) D. Don, *Ethulia paniculata* Schkuhr, *Grangea bicolor* (Roth) Willd. ex Loudon, *Grangea latifolia* Desf., *Grangea latifolia* Lam. ex Poir. (non Desf.), *Hippia bicolor* (Roth) Sm.

Herbs 0.1–0.8(–1.3) m tall; stems erect or ascending to less commonly decumbent, simple or few-branched distally, pilose to sparsely villous or glabrate. **Leaves** usually petiolate; blade (2–)4–10 × (0.5–)1–6.5 cm, usually lyrate-pinnatifid and ovate or obovate in outline (figs. 1, 2), less commonly unlobed and lanceolate to elliptic, larger secondary veins closely spaced proximally and remote distally, surfaces sparsely arachnoid-pubescent or pilose to subglabrous, typically eglandular, sometimes slightly rugulose adaxially, base obtuse to attenuate, marginal lobes 1–2(–3) per side, each usually 1–3.5 × 0.3–2 cm with the proximal pair obviously the smallest, oblong to obovate, irregularly serrate or crenate, terminal lobe 3–5.5 cm long, ovate to cordate, apex acute to obtuse; petiole 1–3.5 cm long. **Capitulescence** 4–7 × 3–6 cm, loosely pyramidally paniculate, of several axillary branchlets usually terminated by a 3–9(–18)-capitulate cyme; peduncles 0.3–2.5 cm long, slender, often 1–2-bracteolate; bracteoles 1–2.5 mm long, linear-lanceolate. **Capitula** 2–4 × 2–4 mm, in early anthesis slightly bicolored with the corollas of the disk florets darker than in the marginal pistillate florets; involucre 1–1.3 mm long, crateriform; phyllaries 10–15, 0.4–0.7 mm diam., oblanceolate to oblong, glabrous or subglabrous, margins slightly scarious, sometimes fimbriate, apex acute to obtuse; receptacle in fruit globose or broadly obconical, flattened apically. **Marginal pistillate florets** 100+, 4–8+-seriate (fig. 3); corolla 0.4–0.7 mm long, tubular, cylindrical throughout, white, apical denticulations < 0.1 mm long, corolla moderately persistent and often deflected upwards; style weakly exserted. **Disk florets** 15–30; corolla 0.6–1.2 mm long, campanulate, 4-lobed, ochroleucous or chloroleucous (or lobes sometimes pinkish), tube shorter than limb, lobes 0.2–0.4 mm long; anthers 0.3–0.4 mm long, about 2.5–3 times long as wide, ovate-sagittate, yellowish or brownish, appendage minute, endothecial pattern indistinct, periclinal and polar cell walls seemingly thickened (fig. 4A); style branches 0.1–0.2 mm long, apex acute, papillose abaxially, papillae rounded apically (fig. 4B). **Cypselae** 1–1.5 mm long, longer than corollas, in fruit the outer cypselae often directed downward (by receptacle growth) and obscuring the shorter involucre, sparsely glandular distally or especially apically, apex obtuse to sometimes emarginate; pappus absent in ray florets, disk cypselae epappose or with 1–2 bristles 0.4–0.8 mm long. $2n = 18$.

American exsiccatae examined: **GUATEMALA. Baja Verapaz**: Reserva Natural, Río Escondido, Purulhá, 15°06'41"N, 90°11'02"W, 1500 m, 24 Apr 2010, *Holt E6843* (to be deposited in HULE and MO, photograph of an unmounted pressed specimen in MO), same locality, 2 Apr 2011, *Holt E9974* (to be deposited in HULE and MO, photograph of an unmounted pressed specimen in MO). **Huehuetenango**: Sierra de los Cuchumatanes, sin. elev., 15–23 Sep 2006, *Guerrero 72* (USCG, photograph in MO).

Distribution and ecology: *Dichrocephala integrifolia* is native to Africa, Asia, and the western Pacific region and has been introduced into Australia, Europe, and now Guatemala. It is expected in adjacent regions of Central America and in the West Indies. In Guatemala, *D. integrifolia* occurs in disturbed areas at mid-elevations and is known to flower in April and September.

Dichrocephala integrifolia is the most common species of the genus and is a taller plant with larger leaves when compared to the two other species [i.e., African-centered *D. chrysanthemifolia* (Blume) DC. and Asian-centered *D. benthamii* C.B. Clarke]. Each of the three species of *Dichrocephala* is known from both Africa and Asia. *Dichrocephala integrifolia*, although described with the epithet "integrifolia," has leaves that are usually lyrate-pinnatifid and serrate or crenate.

The basionym *Hippia integrifolia* was overlooked for much of the 1800s, and *Dichrocephala integrifolia* was often called *D. latifolia* DC. The name *D. latifolia*, however, was noted by Schlechtendal (1852) as an illegitimate replacement name for *Cotula bicolor* Roth (1800), and Schlechtendal (1852) provided the combination *D. bicolor* (Roth) Schltdl. and listed *D. latifolia* in synonymy. Use of the illegitimate name *D. latifolia* has, nevertheless, continued in several floras (e.g., Humbert 1960), although in other floras the nomenclaturally correct *D. bicolor* has on occasion been adopted (e.g., Kaur & Sharma 2004). Andrews (1956), Davis and Grierson (1975), Wild (1975), and Fayed (1979) treated *D. bicolor* and *D. latifolia* in taxonomic synonymy of *D. integrifolia*.

Because *Dichrocephala integrifolia* has traditionally been called *D. latifolia*, I consider it useful to list in synonymy the known homotypic synonyms of both *Hippia integrifolia* and *Cotula bicolor* and also to include *Grangea latifolia* Desf., which may be nomenclaturally independent of *C. bicolor*. Full synonymy with literature references and typology was given by Fayed (1979). Although Fayed (1979) recognized two subspecies of *D. integrifolia*, I see no obvious distributional or morphological trends and accordingly treat the species broadly and without infrataxa. The species is well-known and has been illustrated several times under several names, including as *Sphaeranthus africanus* L. sensu N.L. Burman, Fl. Ind. tab. 60, fig. 2, 1768, an illustration that by a decade predates the protologue of *D. integrifolia*.

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Figure 1. *Dichrocephala integrifolia*. Illustration reproduced from Lamarck, *Tabl. Encycl.* tome 2, 4(1): t. 699 top left, f. 1 sub "*Grangea*," 1796. The larger leaf on the left was incompletely figured in Lamarck. A and B show details of capitula and C depicts an obovate epappose cypsela, albeit positioned upside down

Figure 2 *Dichrocephala integrifolia* Distal portion of stem showing capitulescence and lyrate-pinnatifid leaves. (photograph by Sune Holt, *Holt E9974*)

Figure 3. *Dichrocephala integrifolia*. Close-up of capitula showing the pluriseriate marginal pistillate florets with ascending tubular white corollas and the less numerous disk florets with pale green corollas. (photograph by Sune Holt, *Holt E6843*)

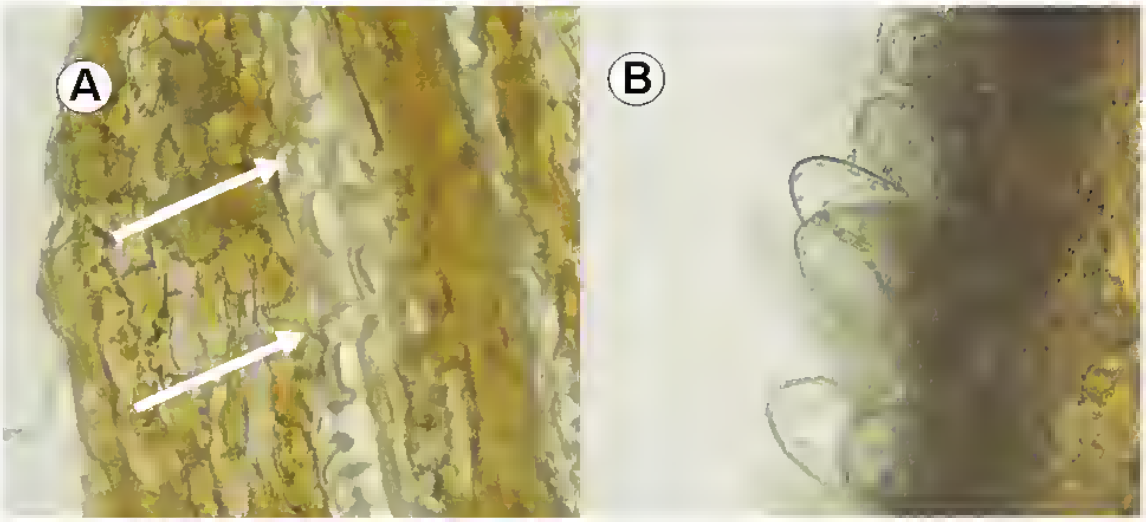

Figure 4 *Dichrocephala integrifolia* floral microcharacters A Anther theca with arrows pointing to the thickened endothecial cell walls B Abaxial style branch appendage papillae with rounded apices (*Averyanov et al VN 418*, MO)